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# BIBLIOGRAPHY

OF THE

# NORTHEASTERN AND ALLEGHENY FOREST EXPERIMENT STATIONS 1923-1949

*Northeastern*
*Forest Experiment Station*

*Upper Darby, Pa.*
*V.L. Harper, Director*

U.S. DEPARTMENT OF AGRICULTURE

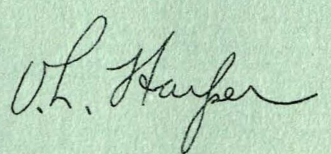
FOREST SERVICE

# FOREWORD

This bibliography lists the contributions to forest-research literature of the Federal forest experiment stations that have served the Northeast during the period 1923–49. At one time two such stations served the region: the Northeastern Forest Experiment Station, established in 1923 at Amherst, Mass., later moved to New Haven, Conn.; and the Allegheny Forest Experiment Station, established in 1927 at Philadelphia. In 1942, early in the war, these two stations were combined, with headquarters in Philadelphia; and in 1945 the combined station was renamed Northeastern Forest Experiment Station. Now, with headquarters at Upper Darby, Pa., the Northeastern Station serves a region that includes 12 states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, New Jersey, Delaware, Maryland, and West Virginia.

In general, this bibliography is limited to publications relating to the Northeast and written by members of the staffs of these experiment stations and by collaborators who were closely associated with these stations. Most of these collaborators were from agencies such as the U. S. Department of Agriculture's Bureau of Entomology and Plant Quarantine and Bureau of Plant Industry, Soils and Agricultural Engineering.

The bibliography was compiled by E. vH. Larson, editor, Northeastern Forest Experiment Station, with the assistance of other members of the staff. The Station gratefully acknowledges the generous assistance given by Sarah W. Parker, librarian of the Philadelphia Branch of the U. S. Department of Agriculture Library, and her staff.



V. L. HARPER, director
Northeastern Forest Experiment Station

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# BIBLIOGRAPHY

OF THE

# NORTHEASTERN AND ALLEGHENY FOREST EXPERIMENT STATIONS

# 1923-1949

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## INTRODUCTION

THE LITERATURE references in this bibliography are grouped by subject matter, as indicated in the table of contents. In each subject-matter classification the items are listed by authors, alphabetically. Under each author the listing is chronological.

Each item appears in only one place. Each item was placed in the category it seemed most closely related to. For example, some information about the spruce budworm may be found under "Forest Protection"; other items about it are listed under "Forest Management and Silviculture." Some cross references have been inserted to guide the reader.

Processed material (mimeographed and multilithed) has been included as well as printed material. Although

some of the publications listed are rather brief, they were included in the hope that they may be useful.

An asterisk (*) to the left of an item indicates that copies or reprints of the publication may be obtained (in limited numbers) from the Northeastern Forest Experiment Station, 102 Motors Avenue, Upper Darby, Pa. Many of the publications not available for distribution or loan by the Northeastern Station can be found at forestry schools and libraries. Photoprint copies of most of the items listed are available at slight cost from the U. S. Department of Agriculture Library, Washington, D. C.

An alphabetical index of authors will be found at the back of the bibliography.

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# GENERAL

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Allegheny Forest Experiment Station.
1939. KANE EXPERIMENTAL FOREST OF THE ALLEGHENY FOREST EXPERIMENT STATION. Allegheny Forest Expt. Sta. 13 pp., illus. Philadelphia.

A pamphlet describing the Kane Experimental Forest in Pennsylvania, and the research studies being made there in ecology, silvics, cuttings, stand improvement, mensuration, and artificial regeneration.

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1943. TIONESTA NATURAL AND SCENIC AREA, ALLEGHENY NATIONAL FOREST. Allegheny Forest Expt. Sta. 10 pp., illus. Philadelphia.

A pamphlet describing a virgin hemlock-beech area (4,131 acres) dedicated in 1940 for scientific study and for education and enjoyment of the public. Topography, tree and herbaceous species, birds, wildlife, and some individual tree specimens are described.

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1943. WARTIME WORK OF THE ALLEGHENY FOREST EXPERIMENT STATION. Allegheny Forest Expt. Sta. Tech. Note 42. 2 pp. Philadelphia.

Describes the wartime work of the Station in aiding sawmill owners and loggers. Special surveys were made for other Government agencies to show current lumber production in the Northeast.

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* COPIES OR REPRINTS ARE AVAILABLE IN LIMITED QUANTITIES AT THE NORTHEASTERN FOREST EXPERIMENT STATION, 102 MOTORS AVENUE, UPPER DARBY, PA.

Anderson, A. H.
1949. THE NEED FOR A RESEARCH CENTER IN THE ALLEGHENY PLATEAU FORESTS. Forest Leaves 34 (1): 10-12.

Recommends the Northeastern Forest Research Advisory Council advocate that a research center be established in the Allegheny Plateau of Pennsylvania and New York to work on the forest problems of that region.

Behre, C. Edward.
1933. NORTHEASTERN FOREST EXPERIMENT STATION SURVEYS ITS FIRST TEN YEARS. Northeast. Forest Expt. Sta. Occas. Paper 2. 7 pp. New Haven.

Brief history of the experiment station. In its first 10 years two experimental forests (Bartlett and Gale River) were established for research in the northern spruce-hardwood forests. Studies were made on growth, yield, management, fire statistics, control of insects and diseases, soils, plantings, and associated subjects.

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1933. NORTHEASTERN FOREST EXPERIMENT STATION SURVEYS ITS FIRST TEN YEARS. Jour. Forestry 31: 694-695.

See above.

Dana, Samuel T.
1923. WHAT THE NORTHEASTERN FOREST EXPERIMENT STATION SHOULD AIM AT. Jour. Forestry 21: 40-43.

The Northeastern Forest Experiment Station should help to coordinate the research work now under way (by forest schools, States, industries, and private owners) and conduct research in fields and on problems not already covered. The Federal forest experiment station is the logical agency to bring about such coordination. Unrestricted by State lines or institutional limitations, it should become the center for forest research in the Northeast.

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1924. FOREST INVESTIGATIONS IN THE NORTHEAST. Northeast. Forest Expt. Sta. 5 pp. Amherst.

A digest of statements made on forest research before the pulp and paper advisory committee to the Secretary of Agriculture. Five research projects are recommended for immediate study; nine other problems on which research is needed are listed.

Dana, Samuel T.

1926. OUR SOCIETY'S AIMS.
Jour. Forestry 24: 4-11.

The president of the Society of American Foresters states the aims of the organized professional foresters. He discusses professional standards, forestry's proper place in National affairs, the advancement of forestry as a science and art, services to members, and organization.

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1926. THE MISSION OF FOREST RESEARCH.
Jour. Forestry 24: 667-672.

Outlines the purpose of forest research with some examples from the work of the Northeastern Forest Experiment Station. The author says the progress of forestry depends largely on the extent to which research receives adequate moral and financial support.

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1926. FORESTRY RESEARCH IN THE UNITED STATES.
Empire Forestry Jour. 5: 256-263.

A paper presented before the World's Forestry Congress in Rome, 1926. Describes the forest situation in the United States and the research effort being made by the Forest Service at its regional experiment stations and Forest Products Laboratory. The research work of nonfederal agencies is also described.

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1927. WORLD FORESTRY CONGRESS.
Jour. Forestry 25: 50-56.

The World Forestry Congress held in Rome in 1926 was attended by more than 700 delegates from some 60 different countries. The American delegation believed that one of the chief values of the Congress was that it established closer and more cordial relations among foresters throughout the world.

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1927. FORESTRY AND THE SOCIETY.
Jour. Forestry 25: 123-128.

The retiring president of the Society of American Foresters urges the members of the society to greater action in advancing the interests of the profession.

Dana, Samuel T.
1927. EUROPEAN FOREST EXPERIMENT STATIONS.
Yale Forest School News 15: 2-3.

Following the World's Forestry Congress in Rome the author visited several European experiment stations. These are his brief and rather general comments about the work and organization of experiment stations he visited in Italy, Czechoslovakia, Germany, Austria, Finland, and Sweden.

* Forbes, R. D.
1930. WHAT UNCLE SAM DOES TO SOLVE THE FOREST PROBLEM.
Engineers and Engineering 47 (4): 89-92.

The author states the forest problem in four aspects: drain in excess of growth, waste in utilization, increasing remoteness of markets from source of supply, and idle land. He explains the functions of the Forest Service and its efforts to solve the problem.

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1930. THE NATIONAL FOREST RESERVATION COMMISSION AND FOREST RESEARCH RESERVES. Science 71: 505-506.

A brief discussion of the policy of the National Forest Reservation Commission in regard to "research reserves". The Commission recognizes the "desirability of the preservation of unmodified or virgin forest areas as nature laboratories for the promotion of silviculture".

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1930. PROGRESS IN THE RESEARCH RESERVE PROGRAM.
Jour. Forestry 28: 574-575.

General understanding of the principles of research reserves (in the setting aside of the Heart's Content virgin area in Pennsylvania) is greeted as a hopeful sign by foresters who have sighed over the lack of virgin areas suitable for research reserves within the present boundaries of the eastern National Forests.

* ---

1930. THE FEDERAL FOREST EXPERIMENT STATIONS.
Allegheny Forest Expt. Sta. 4 pp. Philadelphia.

An outline of the forest problem in the United States and the role of the U. S. Forest Service's experiment stations in providing information needed for meeting the forest problems of the various regions. Some details of the research programs of the Allegheny Forest Experiment Station.

Forbes, R. D.

1934. THE THOUSANDTH ACRE.
Amer. Forests 40: 51-54, illus.

Describes the virgin stands of the Tionesta forest in northwestern Pennsylvania. The author compares conditions in virgin stands, which comprise only one thousandth of the forested area in the territory of the Allegheny Forest Experiment Station, with unfavorable conditions in the remaining areas. He points out the opportunity to learn from virgin areas the natural processes that build the forest to its climax condition.

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1937. DEEP IN THE WOODS.
Forest Leaves 27 (1): 1-2, 10-13.

Discussion of the condition of the Allegheny forests, the causes of their serious deterioration, and the services that forests render man. The author describes the continuing need for reliable information that can be obtained only through research, and outlines some of the studies being carried out by the Allegheny Forest Experiment Station.

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1938. "IN COOPERATION WITH THE UNIVERSITY OF PENNSYLVANIA."
Pa. Univ. Gen. Mag. and Hist. Chron. 40 (3): 263-269.

The Allegheny Forest Experiment Station of the U. S. Forest Service had its first headquarters in a building in Philadelphia maintained "in cooperation with the University of Pennsylvania". The author explains this cooperation and describes the research work done by the experiment station.

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1940. ACCOMPLISHMENTS OF THE ALLEGHENY FOREST EXPERIMENT STATION 1927-1940. Allegheny Forest Expt. Sta. 29 pp. Philadelphia.

Review and reappraisal of accomplishments of the Allegheny Forest Experiment Station in 1927-1940. Detailed list of publications by personnel of the station during this period is included.

Forbes, R. D.
1941. FEDERAL FOREST RESEARCH IN PENNSYLVANIA.
Pa. Univ. Morris Arboretum Bul. 3 (18): 24-28.

A brief discussion of some of the forest problems in Pennsylvania and general outline of research being carried on by the Allegheny Forest Experiment Station. The problem of regenerating white pine is cited.

Harper, V. L.
1946. RESEARCH IN MANAGEMENT AND UTILIZATION OF FORESTS IN PENNSYLVANIA. Forest Leaves 36 (1): 7-8.

Brief description of forestry research by the Northeastern Forest Experiment Station, aimed to help solve critical forestry problems in Pennsylvania. Forest management and utilization studies in the Anthracite Region and on the Allegheny Plateau are outlined. Some current projects and results are described.

---
1949. NEW HORIZONS IN FORESTRY.
Forest Leaves 34 (1): 1-2, illus.

An editorial. Pennsylvania suffers a serious deficiency of timber products. Besides providing lumber, pulpwood, and other wood products, the forests are needed to provide reliable water supplies, recreation, and wildlife habitat, and to help prevent floods and erosion. Research in forestry is relatively young, but new developments of many kinds appear on the horizon as research pushes ahead. These developments may help us make better use of our forest resource.

Hough, A. F.
1940. THE ALLEGHENY FOREST EXPERIMENT STATION.
Forest Leaves 30 (1): 9-10.

The Allegheny Forest Experiment Station was created in 1927 to study forest problems in the Middle Atlantic States. Experimental areas were established (1) in Huntingdon County, Pennsylvania; (2) in southern New Jersey; (3) on the Eastern Shore of Maryland; (4) in Maryland between Baltimore and Washington; and (5) in the Allegheny National Forest.

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1940. TIONESTA FOREST FORMALLY SET ASIDE.
Amer. Forests 46: 565.

Anounces that the Federal Government has purchased 4,131 acres of virgin hemlock-hardwood forest in the Tionesta

Creek area for inclusion in the Allegheny National Forest. The area is divided into two parts: (1) a scenic area for the public and (2) an undisturbed area dedicated to scientific research. The area contains hemlock trees 300 to 500 years old and beech trees 350 years old.

Hough, A. F.
1941. TIONESTA AREA SET ASIDE.
Nature Mag. 34 (3): 140, illus.

See above.

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1941. NATURAL AREA ESTABLISHED IN NORTHWESTERN PENNSYLVANIA VIRGIN FOREST. Ecology 22: 85-86.

See above. Emphasis on value for ecological studies.

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1942. FORESTS IN WAR AND PEACE.
Forest Leaves 32 (1): 5-6.

The author points out the vital part forest products play in both war and peace. He suggests that a National forest policy be adopted to regulate and improve cutting practices on privately owned forest lands.

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1944. THE TIONESTA NATURAL AND SCENIC AREA.
Chron. Bot. 7: 272-273.

A description of the species composition of this climax forest, which is the largest single remnant of the original forest that once covered 6 million acres of the Allegheny Plateau; and a discussion of the opportunities it offers for research in relationships between plant and animal life, hydrologic cycles, microclimate, and "frost pockets".

* Larrimer, W. H., and Schreiner, Ernst J.
1949. ARBORETUMS, PLACES OF BEAUTY AND SCIENCE.
U. S. Dept. Agr. Yearbook 1949: 398-402.

Few things are more worthy or more enjoyable than one's own collection of trees. Even 1 acre is ample for 20 or 25 specimens. The authors tell how to plan an arboretum. Some historical and present arboreta are described, and ways in which arboreta can serve the public are listed.

McQuilkin, W. E.
1949. FOREST RESEARCH IN THE ANTHRACITE REGION. Forest Leaves 34 (1): 18-19.

An account of the research studies being carried out by the Northeastern Forest Experiment Station's Anthracite Research Center in the Anthracite Region of Pennsylvania. Planting studies are being made to meet problems of regenerating scrub oak barrens and mine spoil banks. Plans for studies at the Pocono Experimental Forest, near Gouldsboro, Pa., are outlined.

Nofziger, Ed.
1945. JOE BEAVER. Northeast. Forest Expt. Sta. Occas. Paper 7. 12 pp., illus. Philadelphia.

A booklet of cartoons featuring one Joe Beaver, a busy fellow who, in his fashion, is a one-beaver crusade for better management and protection of our forests, and against the carelessness and shortsightedness of mankind.

* ----------
1945. TWO TREES. Amer. Tree Assoc. 49 pp., illus. Washington, D. C.

A picture-story pamphlet (in linoleum-block print) about two trees. One was the victim of poor woodland management, and he never amounted to very much. The other benefited from good forest-management practices, and he eventually became a fine, useful, saw-timber tree.

Northeastern Forest Experiment Station.
1924. FOREST INVESTIGATIONS UNDER WAY IN NEW ENGLAND AND NEW YORK. Northeast. Forest Expt. Sta. 83 pp. Amherst.

A list of forest-research projects that were being conducted by various agencies, schools, and private companies during 1924.

---
1927. FOREST RESEARCH IN THE NORTHEAST: A SUMMARY OF PERMANENT SAMPLE PLOT EXPERIMENTS BY ALL AGENCIES IN THE REGION. Northeast. Forest Expt. Sta. 40 pp. Amherst.

A summary, by States, of sample-plot experiments in forestry being carried on by all agencies--Federal, State, and private. Information was obtained by questionnaire.

Northeastern Forest Experiment Station.
1930. FOREST INVESTIGATIONS UNDER WAY IN NEW ENGLAND AND NEW YORK, May 1, 1930. Northeast. Forest Expt. Sta. 122 pp. Amherst.

A list of research projects dealing with forest problems in the Northeast. For each project the scope, status, plans, and agency responsible are given.

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1944. NORTHEAST FORESTS IN THE POSTWAR PERIOD. Northeast. Forest Expt. Sta. 11 pp. Philadelphia.

A region-wide plan for developing and utilizing northeastern forests more intensively during the transition period from war to peace. It includes an appraisal of present forest conditions, the formulation of long-term forestry objectives, and the action needed to achieve these objectives.

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1948. BELTSVILLE EXPERIMENTAL FOREST. Northeast. Forest Expt. Sta. 7 pp. Upper Darby.

A pamphlet that describes the experimental forest briefly and outlines the forest research problems being studied there.

* ---

1948. DELAWARE-LEHIGH EXPERIMENTAL FOREST. THE FIRST UNIT OF THE DELAWARE BASIN RESEARCH CENTER. Northeast. Forest Expt. Sta. 6 pp., illus. Upper Darby.

A pamphlet that describes the experimental forest briefly and outlines the forest research problems to be studied there.

* Rettie, James C.
1948. FLASH IN THE PAN?
The Land 7: 333-336.

A fable about the geologic development of the Earth and its civilization, as recorded with a time-lapse camera from a planet called Copernicus. The running of the film, which covers 757 million years, takes exactly 1 year for a continuous showing. The film shows the long and slow development of plant life and the soil. Then, in the last few

seconds, it shows the settling and development of America; the vanishing of the forests before fire and ax; the erosion of the soil by water and wind; and the soil, our only real wealth, being cut loose from its ancient moorings and washed into the seas.

S(chnur), G. L.
1938. WILL WE COOPERATE?
Forest Leaves 28 (3): 4.

An editorial predicting that the condition of our forests indicates some sort of regulation of private forest lands must eventually come, but that if forest-land owners cooperate by managing their lands well, there will be a minimum of public regulation.

Schreiner, Ernst J.
1940. RESEARCH ORGANIZATION AND RESEARCH COST ACCOUNTS.
Jour. Forestry 38: 909-915, illus.

The author stresses the need for efficient research organization and accurate cost accounting. The scope and purpose of project analyses, working plans, and jobs as related to organization are defined. Accurate cost accounting is advocated as a measure of the value of specific jobs as well as a brake on wasteful expenditures.

* ----------
1947. DO WE NEED A SHADE TREE SERVICE?
Amer. Forests 53 (7): 296-298, 334, illus.

Author recommends a National Shade Tree Service be established to make available for public use the bits of current information and research results on shade-tree selection, propagation, and maintenance. Cooperative research efforts are recommended. Information now available is scattered and relatively unpublicized.

----------
1949. WHY A SHADE TREE SERVICE.
Amer. Forests 55 (3): 26-27, 43-45, illus.

More argument for a National Shade Tree Service. Despite the great and widespread value of shade trees (value of elms alone is estimated at $200,000,000) there is little basic information available for use in protecting shade trees. Fundamental research is needed. It should be coordinated in six fields: engineering, entomology, pathology, soil science,

physiology, and genetics. The proper agency to carry out and coordinate such research would be a National Shade Tree Service.

Shirley, Hardy L.
1941. A PRIMEVAL LABORATORY IN PENN'S WOODS.
Sci. Monthly 53: 290-293, illus.

Announces Federal acquisition of the Tionesta virgin forest area.

* ----------
1942. WAR'S CHALLENGE TO FOREST CONSERVATIONISTS.
Forest Leaves 32 (2): 1-2.

Large quantities of lumber and pulpwood are required for wartime production. The author urges foresters and timber operators to cease cutting immature timber. Although it is necessary to cut mature timber to fill wartime needs, we must also plan for the future.

* ----------
1943. OPPORTUNITIES IN FORESTRY.
Jour. Forestry 41: 83-86.

The author points out that forestry problems have world-wide as well as local significance. The jobs ahead in forestry are tremendous, and the importance of forests to society is taking on greater significance.

----------
1943. FORESTRY IN THE POSTWAR WORLD.
Forest Leaves 33 (2-3): 5-9.

The author surveys the many chemical and physical uses of wood that are yet undeveloped. He urges the regulation of timber cutting practices and cooperation with all other countries in building up the timber resources of the world.

* ----------
1943. RESEARCH AT THE ALLEGHENY FOREST EXPERIMENT STATION.
Pa. Acad. Sci. Proc. 17: 90-94.

A description of the research work of the Allegheny Forest Experiment Station, prefaced by an outline of the relationship of forestry research to other sciences. Some of the practical applications of research results are described. The author tells of the effect of the war on forestry research,

and predicts that the need for information about our forest resource will be greater than ever after the war.

* Weitzman, Sidney.
1949. THE FERNOW EXPERIMENTAL FOREST.
Northeast. Forest Expt. Sta. 16 pp., illus.
Upper Darby.

A booklet describing the Fernow Experimental Forest near Parsons, W. Va., the forest problems of the area, and the plans and programs for timber-management and watershed-management research to be carried on there by the Northeastern Forest Experiment Station. The forest contains 3,640 acres of rather typical second-growth Appalachian hardwoods.

# FOREST BOTANY

## PHYSIOLOGY

Afanasiev, Michel.
1939. EFFECT OF INDOLEBUTYRIC ACID ON ROOTING OF GREENWOOD CUTTINGS OF SOME DECIDUOUS FOREST TREES. Jour. Forestry 37: 37-41, illus.

Indolebutyric acid stimulated root growth on greenwood cuttings of gray birch, white birch, red maple, and a white poplar hybrid. Negative results were obtained from cuttings of aspen and hard maple. The most effective single treatments for individual species are indicated.

Burkholder, P. R., and Snow, A. G., Jr.
1942. THIAMIN IN SOME COMMON AMERICAN TREES. Torrey Bot. Club Bul. 69 (6): 421-428.

The approximate thiamin activity (as indicated by assay of buds, leaves, and bark) of some common American trees was studied at different seasons of the year. A difference was found in thiamin activity between seasons. Girdling reduced thiamin activity below the girdle after 4 to 6 weeks.

* Church, Thomas W., Jr.
1949. EFFECTS OF DEFOLIATION ON GROWTH OF CERTAIN CONIFERS. Northeast. Forest Expt. Sta. Paper 22. 12 pp. Upper Darby.

A summary of research literature. Research studies are summarized on defoliation by spruce budworm, other insects (gypsy moth, hemlock looper, tussock moth, pine butterfly, larch sawfly), fire, fungi, and climatic agents.

* Edgerton, L. J.
1944. TWO FACTORS AFFECTING ROOTING OF RED MAPLE CUTTINGS. Jour. Forestry 42: 678-679.

Data presented indicate that cuttings from the lower half of the crown root more readily than those from the upper half, for both male and female trees; that cuttings from trees with a light fruit crop root better than from trees with a heavy fruit crop; and that rooting ability is not associated genetically with sex.

Hough, A. F.
1936. EPICORMIC BRANCHING OF ALLEGHENY HARDWOODS. Allegheny Forest Expt. Sta. Tech. Note 10. 2 pp. Philadelphia.

Five years after selective cuttings in the Allegheny National Forest, epicormic branching was observed on many of the trees left. Growth and vigor were apparently not affected, but clear length of stem was. Epicormic branching was most prevalent on suppressed or intermediate trees. If full-crowned trees are reserved in selective cutting, few epicormic branches will result.

Little, Elbert L., Jr.
1944. LAYERING AFTER A HEAVY SNOWSTORM IN MARYLAND. Ecology 25: 112-113.

Late in March 1942 a 20-inch snowfall near Beltsville, Md. bent the tops and branches of many plants to the ground. The ensuing summer was wetter than normal. Examinations in the fall of the same year revealed that specimens of 15 species of trees and shrubs had rooted where the growing tips touched the ground. The most rooting occurred in those species that normally root easily from untreated cuttings.

* Maki, T. E., and Marshall, Hubert.
1945. EFFECTS OF SOAKING WITH INDOLEBUTYRIC ACID ON ROOT DEVELOPMENT AND SURVIVAL OF TREE SEEDLINGS. Bot. Gaz. 107: 268-276, illus.

Before planting, the roots of various hardwood and coniferous seedlings were soaked 4 to 24 hours in aqueous solutions of different growth regulators, chiefly indolebutyric acid. The treatments produced no substantial increases in survival. These results offer little hope that soaking forest planting stock in solutions of growth regulators might increase the survival of plantations.

Maki, T. E., Marshall, H., and Ostrom, C. E.
1946. EFFECTS OF NAPHTHALENEACETIC ACID-SPRAYS ON THE DEVELOPMENT AND DROUGHT RESISTANCE OF PINE SEEDLINGS. Bot. Gaz. 107: 297-312.

Seedlings of jack, loblolly, white, and red pine were sprayed in September, October, and March with various concentrations of naphthaleneacetic acid in 1 percent Dowax emulsion. Other seedlings were top-pruned. All treatments were tried in an attempt to inhibit growth and increase resistance to drought, but white and red pines were not affected by the growth-regulator treatments. Certain of the treatments did inhibit growth of jack and loblolly pines, but in most cases did not increase drought resistance.

* Marco, Herbert F.
1939. THE ANATOMY OF SPRUCE NEEDLES. Jour. Agr. Res. 58: 357-368, illus.

The author's study shows that epidermal cells have teeth that anchor the cuticle firmly; the cells are joined together dovetail fashion. The structure of the guard cells is unlike any other heretofore described: the thickened upper and lower walls in the region of the stoma are separated by two extremely thin, flexible membranes; when the stoma are opened, the membranes collapse and the two guard-cell walls come into contact. The number of strengthening cells adjacent to the bundles is of diagnostic value: the spruces have two fibrovascular bundles in their petioles, which become fused into one in the needle; this bundle is separated vertically into two equal parts by a raylike sheath of parenchymatous cells.

* Marshall, Hubert, and Maki, T. E.
1946. TRANSPIRATION OF PINE SEEDLINGS AS INFLUENCED BY FOLIAGE COATINGS. Plant Physiol. 21: 95-101, illus.

A test of protective coatings on the foliage of three pine species to reduce transpiration and lessen drought killing was made on 30 seedlings lifted from the nursery, potted in fine sand with ample moisture, and exposed to artificial drought conditions for a 5-day period. The top-dipped specimens transpired 40 percent less than the untreated controls during the first 4 days of drought. Higher temperature and lower relative humidity during the fifth day produced severe injury to white pine, red pine, and some of the loblolly pine controls and increased water loss of the treated plants. Water loss was shown to vary directly as the fresh weight of the seedling.

* Ostrom, Carl E.
1945. EFFECTS OF PLANT-GROWTH REGULATORS ON SHOOT DEVELOPMENT AND FIELD SURVIVAL OF FOREST-TREE SEEDLINGS. Bot. Gaz. 107: 139-183, illus.

The results of treating seedlings of red, loblolly, shortleaf, pitch, and table-mountain pines, red spruce, tuliptree, and white ash with naphthaleneacetic acid, naphthalenemethylacetate, naphthalene acetamide, and mixtures of naphthalene compounds with or without indolebutyric acid. The studies were divided into (1) nursery bed, (2) prestorage, and (3) preplanting treatments. In general, the use of growth regulators on conifers was not particularly encouraging; they may have a wider application on hardwoods.

* Reineke, L. H.
1941. FRUITING OF 10-YEAR OLD CONIFERS. Northeast. Forest Expt. Sta. Tech Note 47. 3 pp. New Haven.

A comparison of cone production on 10-year-old (planted) white spruce, red pine, and white pine trees. Cone production on all three species is related to height growth. Trees less than 3 feet high generally do not produce cones. The number of cones varies according to height growth.

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1942. EFFECT OF PREGERMINATION AND RADICLE DAMAGE ON FIRST-YEAR DEVELOPMENT OF RED OAK. Jour. Forestry 40: 346-347.

In an experimental sowing of ungerminated and pregerminated red oak acorns, pregermination did not result in significant differences in seedling growth during the first year. Removal of half the pregerminated radicle before sowing caused some thickening and shortening of taproot and stem; minor radicle injuries did not affect seedling development.

* Snow, Albert G., Jr.
1938. USE OF INDOLEBUTYRIC ACID TO STIMULATE THE ROOTING OF DORMANT ASPEN CUTTINGS. Jour. Forestry 36: 582-587, illus.

Dormant 6-inch cuttings of quaking and bigtooth aspens rooted up to 70 percent when cuttings were made just before the buds burst. Hormone treatment was necessary, the optimum being a soaking for 22 to 46 hours in a solution containing 5 to 10 mg./liter indolebutyric acid. Cuttings taken in January and early February failed to root.

* Snow, Albert G., Jr.
1939. CHEMICALLY-INDUCED ROOTING OF SUGAR MAPLE CUTTINGS. Northeast. Forest Expt. Sta. Tech. Note 27. 1p. New Haven.

Cuttings were taken from young trees on June 12, July 7, and July 19 and partially immersed in various concentrations of a water solution of indolebutyric acid for varying periods of time. Results indicate that the June cuttings in a concentration of 50 milligrams of indolebutyric acid per liter gave the best result. Little success was obtained with cuttings taken after the middle of July.

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1940. ROOTING WHITE PINE CUTTINGS. Northeast. Forest Expt. Sta. Occas. Paper 11. 6 pp., illus. New Haven.

The rooting of greenwood cuttings proved more successful when the cuttings were made from trees in the younger age classes. The greatest rooting response was obtained from cuttings farthest removed from the terminal leader. Maximum average rooting was obtained by treating with indolebutyric acid followed by auxin dust. Cuttings from individual white pine trees showed considerable inherent clonal variation in rooting ability.

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1941. EFFECT OF NEEDLE REMOVAL ON SURVIVAL OF WHITE PINE CUTTINGS. Northeast. Forest Expt. Sta. Tech. Note 38. 2 pp. New Haven.

Any reduction of leaf area is detrimental to survival of white pine cuttings. Clipping the upper needles just above the bud usually resulted in mortality within 2 months. Mortality was attributed to loss of reserve materials such as starches, amino acids, and growth substances, possibly also to destructive effect of fungi.

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1941. EFFECTS OF INDOLEBUTYRIC, INDOLEACETIC, AND NAPHTHALENEACETIC ACIDS ON ROOTING OF RED MAPLE CUTTINGS. Northeast. Forest Expt. Sta. Tech. Note 46. 2 pp. New Haven.

Red maple cuttings were treated before planting with three growth substances: indolebutyric, indoleacetic, and naphthaleneacetic acids. Cuttings were treated for 3 hours with

three different concentrations of each acid before planting. At the end of 2 months best rooting was from indolebutyric acid; naphthaleneacetic acid was nearly as good in higher concentrations. Indoleacetic acid was less effective than the others.

Snow, Albert G., Jr.
1941. WHITE PINE PROPAGATION.
Jour. Forestry 39: 332-333.

The most successful rooting of white pine was obtained in media containing fungi. The fungi may help by providing an extra auxin supply or by aiding in the mineral nutrition.

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1941. VARIABLES AFFECTING VEGETATIVE PROPAGATION OF RED AND SUGAR MAPLE. Jour. Forestry 39: 395-404, illus.

Cuttings from seedling sugar maples and red maple stump sprouts were successfully rooted in outdoor propagating frames when taken in June and early July. The highest percentage of rooting was obtained from 4-inch cuttings soaked for 3 hours in a solution of 50 mg./liter (sugar maple) or 200 mg./liter (red maple) indolebutyric acid. There were pronounced clonal differences in rooting response in the red maple.

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1942. SEX AND VEGETATIVE PROPAGATION.
Jour. Forestry 40: 807-808.

Early July cuttings of red maple showed appreciable clonal differences in rooting response. Furthermore, there was a significant difference between the rooting of cuttings from male and female trees, those from the former rooting 20 percent more than those from females.

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1942. VOLTAGE GRADIENT MEASUREMENTS IN FOREST TREES.
Jour. Forestry 40: 872-876, illus.

There is a definite relationship between voltage gradients and physiological processes in forest trees. Voltage gradients reflect physiological changes before they can be detected by usual external manifestations. Voltage gradients in plants are closely associated with growth processes. The use of voltage gradient determinations as a tool in silvical investigations should have many possibilities.

Waterman, Alma M.
1946. THE EFFECT OF WATER-SOLUBLE EXTRACTIVES FROM THE HEARTWOOD OF TROPICAL AMERICAN WOODS ON THE GROWTH OF TWO WOOD-DECAY FUNGI. Yale Univ. School Forestry, Trop. Woods 88: 1-11, illus.

Report on part of a study of the relative decay resistance of certain tropical woods from Central and South America, in which tests were made of the toxic effects of the decay fungi Lenzites trabea and Poria microspora of the hot-water-soluble extractives from the outer heartwood of selected trees representing 11 species of tropical woods, in comparison with 3 species of North American woods (Pseudotsuga taxifolia, Robinia pseudoacacia, and Quercus alba).

* Way, Roger D., and Maki, T. E.
1946. EFFECTS OF PRE-STORAGE TREATMENT OF HARDWOOD AND PINE SEEDLINGS WITH A-NAPHTHALENEACETIC ACID. Bot. Gaz. 108: 219, 232, illus.

Various methods of application and various concentrations of naphthaleneacetic acid were used as prestorage treatments in attempting to prolong dormancy and lessen deterioration of planting stock in unrefrigerated storage. Storage lasted 5 to 10 weeks. Red and loblolly pines were more susceptible to injury than black locust and eastern red oak.

Westveld, M.
1942. SOME EFFECTS OF INCOMPLETE GIRDLING OF NORTHERN HARDWOODS. Jour. Forestry 40: 42-44.

Different methods of girdling and the behavior of incompletely girdled trees. In this study, peeling was most successful, notching least. Incompletely girdled trees develop callus along bridges across the girdle. Sugar maple showed greatest tenacity, no bridged trees having died; red maple and beech were intermediate, but all bridged yellow birch trees died. Suggestions are made for effective girdling.

# GENETICS

Duffield, John W.
1940. CHROMOSOME COUNTS IN QUERCUS. Amer. Jour. Bot. 27: 787-788.

Chromosome counts were made from sectioned root tips of 19 species of oaks. In all species the 2n number was found to be 24.

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1940. TIME SAVERS FOR FIXING AND DEHYDRATION. Stain Technol. 15 (2): 57-59.

The author describes several short cuts that may be used in fixing and dehydrating root tips for determining chromosome number.

---------- and Snow, Albert G., Jr.
1941. EFFECT OF STORAGE CONDITIONS ON POLLEN LONGEVITY OF PINUS STROBUS AND PINUS RESINOSA. Jour. Forestry 39: 410-411, illus.

After 1 year's storage, at 50 percent relative humidity and 0° to 4° C., pollen of both pine species showed definitely greater germinability than pollen stored under warmer and more humid conditions.

* ---------- and Snow, Albert G., Jr.
1941. POLLEN LONGEVITY OF PINUS STROBUS AND PINUS RESINOSA AS CONTROLLED BY HUMIDITY AND TEMPERATURE. Amer. Jour. Bot. 28: 175-177.

Longevity of Pinus strobus and P. resinosa pollen was tested at four levels of relative humidity and four levels of temperature. Pollen stored at 50 percent relative humidity and at 0° to 4° C. was still more than 80 percent germinable at end of period. Differences between species were not significant. Germinability of pollen stored at low humidities was increased by humidification at 75 percent relative humidity and 4° C. for 12 hours.

Duffield, John W.
1942. POLYPLOIDY IN ACER RUBRUM.
Chron. Bot. 7: 390-391.

Unlike most maples, which have 2n = 26 chromosomes, red maple was found to contain a polyploid series with 2n = 78 and 2n = 104 chromosomes. The hexaploids and octoploids could not be distinguished by the size or frequency of their stomata.

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1942. THE CYTOLOGICAL BASIS OF FOREST TREE IMPROVEMENT.
Jour. Forestry 40: 859-864, illus.

An account of the contributions of cytological studies to forest tree improvement programs. Such studies are especially helpful in planning hybridizations between species, in forecasting whether hybrids are fertile or not, in analyzing the genetic behavior of hybrids, and in planning possible improvement programs within species.

McQuilkin, W. E.
1946. HORMONES AND TREES: ANOTHER PHONY REPORT.
Jour. Forestry 44: 523-524.

In a story in Country Gentleman (February 1946) C. F. Kettering of General Motors was reported to have said he could make trees grow three or four times as fast as normal by feeding them auxins. McQuilkin debunks that statement.

Schreiner, Ernst J.
1937. IMPROVEMENT OF FOREST TREES.
U. S. Dept. Agr. Yearbook 1937: 1242-1279, illus.

Semitechnical account of the status of tree-breeding work in the United States and some foreign countries as of 1937. The author discusses the segregation of varieties, races, and strains of the wild population; selection of the best individuals in each of the best strains; control of seed source; breeding and selection that controls both parents and utilizes the best germ plasm available in wild stocks; the role of early seeding and vegetative propagation in the multiplication of superior individuals; and the production of new types by hybridization and by inducing changes in the normal number of chromosomes. U. S. Dept. Agr. Yearbook Separate 1599 includes 16-page bibliography.

Schreiner, Ernst J.

1938. CREATIVE FORESTRY.
Paper Indus. and Paper World 20: 302-307.

Research on forest tree improvement has been receiving increasing emphasis in the United States since 1924. The author believes that steps involved in the improvement of forest trees will be much the same as in agricultural and horticultural plants; that hybridization is the method by which rapid development of individuals with desirable characteristics may be obtained. He suggests several methods for propagating a large number of individuals in a relatively short time. The mechanics of inducing polyploidy by treatment with colchicine are described.

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1938. FOREST TREE BREEDING TECHNIQUE.
Jour. Forestry 36: 712-715, illus.

Description of techniques: bagging female flowers, collecting and storing pollen, and pollinating the flowers. Variations to suit the flowering habits and flower structures of different species are offered.

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1938. BLOOMING HABIT OF FOREST TREES.
Chron. Bot. 4: 493-494.

Blooming-habit studies have been conducted by the Northeastern Forest Experiment Station on Acer saccharum, A. rubrum, Quercus alba, Q. bicolor, Q. robur, Q. palustris, Q. velutina, Betula papyrifera, B. lenta, B. nigra, and B. populifolia. Significant results were found in sugar maple and red maple. The sugar maple trees present a case of reciprocating dichogamy. Some individual sugar maple trees fall into two groups, one protandrous, the other protogynous. Similar observations were made on red maple.

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1938. RESEARCH IN FOREST GENETICS AT NORTHEASTERN FOREST EXPERIMENT STATION. North. Nut Growers Assoc. Proc. 29: 53-58.

General description of tree-breeding research: selection of superior parent trees, breeding and hybridization, vegetative propagation, and polyploidy. Techniques are described in detail. Observations on blooming habits and flower behavior of several hardwoods species.

Schreiner, Ernst J.

1938. BREEDING OF FOREST TREES IN THE NORTHEASTERN REGION FOR TIMBER AND CROP. Pa. Nut Growers Assoc. Proc. 6: 12-18. Harrisburg.

As more and more forest tree planting is being carried on in the United States it is becoming increasingly desirable to carry out certain practices for the improvement of forest trees. These improvements must be based upon forest requirements and use requirements. Much study is required in the field of forest tree breeding, including hybridization and polyploidy.

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1938. SOMETHING NEW IN TREES?
N. Y. State Ranger School Alumni News 1938: 16-19, 28. illus.

Not until the early part of the 19th century was deliberate cross-breeding between plants recorded. Today attempts are being made to produce superior trees for forest planting, shade trees, lumber and pulp production, and many other uses. The improvement of wild trees by selection and the possibilities of genetic studies of tree breeding are discussed.

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1939. THE POSSIBILITIES OF THE CLONE IN FORESTRY.
Jour. Forestry 37: 61-62.

The author believes the clone will eventually be of great importance to practical forestry because it offers definite advantages in uniformity of growth and the immediate availability of elite individuals for reforestation. In research especially, the use of the clone would eliminate an unknown variable: differences in genetic constitution.

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1939. SOME ECOLOGICAL ASPECTS OF FOREST GENETICS.
Jour. Forestry 37: 462-464.

The author discusses the relationship between forest genetics and forest ecology as the basis for understanding the similarities and differences between forests, between stands, and between individual trees. Work in forest genetics is discussed under three general subject headings: (1) seed origin; (2) individual tree progeny tests; (3) hybridization and selective breeding. The ecological aspects of selection and inheritance studies with forest trees is illustrated by work with the Oxford hybrid poplar.

Schreiner, E. J., and Huberman, M. A.
1940. INDUCED FLOWERING--A TOOL FOR MASS SELECTION, PROGENY TESTS, AND FOREST MANAGEMENT. Jour. Forestry 38: 491-492.

The authors discuss various ways in which flowering may be induced in forest trees. Such induced flowering should prove useful to the practicing forester, since seed years and harvest cuttings can be made to coincide, and seed need be collected only from trees of known superior quality.

---------- and Duffield, John W.
1942. METAXENIA IN AN OAK SPECIES CROSS. Jour. Hered. 33: 97-98, illus.

An apparent case of metaxenia was observed in an interspecific cross between Quercus alba (female) and Q. robur (male). The acorns from the cross were somewhat larger than those of Q. alba, and matured later. The possible effect of the pollen parent on acorn size is noted because of its practical importance to tree-crop research aimed at producing large acorns for livestock or wildlife food.

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1945. AN ANALYSIS OF CINCHONA RESEARCH NEEDS IN GUATEMALA WITH SPECIFIC REFERENCE TO CINCHONA IMPROVEMENT. U.S. Off. Foreign Agr. Relat. 26 pp. Washington.

The author describes past research on cinchona (the bark is a source of quinine) and outlines present research needs for cinchona culture in Guatemala. The most urgent need is not for additional genetic research, but rather for research on nursery culture, and plantation establishment and management. Clonal tests and progeny tests are needed. An intensive improvement is not justified until criteria have been established to define what an "improved type" is.

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1946. TREE BREEDING FOR DESIRABLE QUALITIES AND DISEASE RESISTANCE. Natl. Shade Tree Conf. Proc. 22: 56-59.

Better shade trees and forest trees can be obtained through tree breeding. The tree breeder is concerned with the variation: (1) between species; (2) between varieties or races of the same species; (3) between individuals of the same species, variety, or race. To date too much emphasis has been placed on appearance and not enough on resistance to disease, poor soil, and atmospheric conditions.

Schreiner, Ernst J.
1949. CREATING BETTER TREES.
Forest Leaves 34 (1): 3-4, 14, illus.

A popularized account of tree-breeding research in the Northeast. New hybrids of poplar, birches, and pines show promise. The author senses an increasing demand for better trees. He says that being satisfied with the best trees that nature provides, although unavoidable for the present, is only horse-and-buggy forestry.

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1949. POPLARS CAN BE BRED TO ORDER.
U. S. Dept. Agr. Yearbook 1949: 153-157.

Scientific breeding has produced hybrid poplars that grow faster than native species and resist insects and diseases better. New hybrid poplars can now be bred practically to order. The history and progress of tree-breeding research is outlined, and the special qualities of some of the hybrid poplars are described.

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1949. AMATEUR TREE BREEDERS? WHY NOT?
U. S. Dept. Agr. Yearbook 1949: 158-159.

A scientific background is not necessary to the art of tree breeding; the techniques are relatively simple and inexpensive. Techniques and materials are described briefly.

* Snow, Albert G., Jr.
1939. CLONAL VARIATION IN ROOTING RESPONSE OF RED MAPLE CUTTINGS. Northeast. Forest Expt. Sta. Tech. Note 29. 2 pp. New Haven.

Inherent rooting ability is of primary importance in the immediate utilization of outstanding individual trees. In this study cuttings from 24 different clones were used to test the rooting response both between and within clones. Within clones there was no significant difference. The author concludes tentatively that rooting ability is affected most by inherent differences in natural rooting ability or by inherent differences in response to auxin applications.

Snow, Albert G., Jr., and Duffield, John W.
1940. GENETICS IN FORESTRY.
Jour. Forestry 38: 404-408, illus.

Trees, like other crops, can be improved by controlled breeding. To accomplish this improvement, a great many basic data on tree growth are needed. The time element need be no deterrent to genetic research, since many short cuts are available to the tree breeder.

Wright, Jonathan W.
1948. TREE BREEDING AT THE ARBORETUM.
Pa. Univ. Morris Arboretum Bul. 4 (8): 63-64.

Part of the tree-breeding program of the Northeastern Forest Experiment Station is carried out at the Morris Arboretum in Philadelphia, in cooperation with the University of Pennsylvania. Breeding work, designed to produce fast-growing, high quality timber trees that are resistant to disease and insects, is limited to a few of the most important genera: pine, spruce, fir, maple, oak, and ash. The author describs in detail the methods of bagging and pollinating the female flowers to get hybrid seed.

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1949. PRODUCING ELM SEEDS ON CUT BRANCHES.
Jour. Forestry 47: 210-214, illus.

Indoor pollinations extend the breeding season and give the breeder more latitude in his work. The author reports on indoor pollination tests of American elm (Ulmus americana) and slippery elm (U. fulva), and some tests on Siberian elm (U. pumila), Wych elm (U. glabra), Camperdown elm (U. glabra f. camperdownii), and Wheatley elm (U. carpinifolia f. sarniensis). The most striking feature in the development of elm fruits on cut branches is the rapidity with which all processes take place.

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1949. LOCAL GENETIC VARIATION IN SILVER MAPLE.
Jour. Forestry 47: 300-302.

Report on an experiment with silver maple (Acer saccharinum L. ) in Indiana. Differences in branchiness and winterkilling of seedlings from parent trees from four different localities indicate that there are pronounced genetic differences between wild trees growing within a limited geographic area. This diversity was great enough to be brought out

by one-parent progeny tests of randomly selected parents. It demonstrates the likelihood of distinct races within relatively small distances.

Wright, Jonathan W.
1949. SOME ANOMALOUS FIR FLOWERS.
Univ. Pa. Morris Arboretum Bul. 4 (10): 87-88.

Bisexual flowers were found on Nikko fir (Abies homolepis Sib. and Zucc.) and Greek fir (A. cephalonica Loud. var. Apollinis (Link.) Beiss) during the 1947 breeding season. No bisexual flowers were found on these trees in 1948.

## ECOLOGY

Hough, A. F.
1936. A CLIMAX FOREST COMMUNITY ON EAST TIONESTA CREEK IN NORTHWESTERN PENNSYLVANIA. Ecology 17: 9-28, illus.

A report on the findings of a study made by the Allegheny Forest Experiment Station in 1930 on a 1,200-acre portion of the East Tionesta virgin forest. Location and ownership, physiography and geology, soils, fire, past and present climate, vegetation, dominant stand, height and diameter distribution, mortality, common plants, successional relations, and silvical characteristics are all discussed.

* ---------- and Forbes, R. D.
1943. THE ECOLOGY AND SILVICS OF FORESTS IN THE HIGH PLATEAUS OF PENNSYLVANIA. Ecol. Monog. 13: 299-320, illus.

The authors discuss the major forest associations found in the northern portion of the Allegheny Plateau and the changes in forest composition caused by fire, climatic conditions, and logging. Silvical characteristics of the associated species are discussed, and recommendations are made for future stand treatments that will insure a productive and valuable forest.

* Hough, A. F.
1945. FROST POCKET AND OTHER MICROCLIMATES IN FORESTS OF THE NORTHERN ALLEGHENY PLATEAU. Ecology 26: 235-250, illus.

Frost pockets are found in the northern Allegheny Plateau in stream valleys and basins at the heads of drainages. They result from heavy cutting that is followed by forest fires. In these frost pockets the growing season is shorter than what the native tree species require. Measures needed to convert these areas to good forest growth: complete fire protection, reduction of browsing by animals, and possibly planting of frost-resistant conifers.

Huberman, M. A.
1941. WHY PHENOLOGY?
Jour. Forestry 39: 1007-1013.

In answering the question, the author summarizes the literature on the subject and classifies recent work into three classes: the construction of calendars and charts without regard to meteorological factors, the correlation of plant and animal activities with meteorological factors, and the application of bioclimatic principles based on geographic, topographic, climatic, and biologic factors.

* Little, Silas Jr.
1941. CALENDAR OF SEASONAL ASPECTS FOR NEW JERSEY FOREST TREES. Forest Leaves 31 (4): 1-2, 13-14, illus.

Information on the approximate dates of vegetative and reproductive activities of forest tree species, and on the influence of modifying factors, is of value in different phases of forest management. The author presents data obtained by observation of southern New Jersey species during a 3-year period.

Lutz, H. J.
1930. THE VEGETATION OF HEART'S CONTENT, A VIRGIN FOREST IN NORTHWESTERN PENNSYLVANIA. Ecology 11: 1-29, illus.

Description of the ecological aspects of a virgin woodland area in Pennsylvania, covering past history as well as present conditions. The hemlock-beech association and the hemlock consociation are discussed in detail.

* Morey, H. F.
1931. CLIMATOLOGICAL CHARTS FOR THE ALLEGHENY FOREST REGION. U. S. Monthly Weather Rev. 59 (1): 18-28, illus.

The charts cover Pennsylvania, Maryland, Delaware, and New Jersey, and contain data on mean minimum summer temperature, mean maximum summer temperature, average date of first killing frost in fall, average date of last killing frost in spring, average annual precipitation, average summer precipitation, and average length of growing season.

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1936. A COMPARISON OF TWO VIRGIN FORESTS IN NORTHWESTERN PENNSYLVANIA. Ecology 17: 43-55, illus.

The composition and development of Cook Forest and Heart's Content, two virgin forests in northwestern Pennsylvania, are compared. Ninety-three species were recorded as common to both forests, 91 in Heart's Content alone, and 57 in Cook Forest alone. Heart's Content had a much lower percentage of white pine, a smaller number of trees per acre and a smaller basal area per acre. There is evidence that the key species of white pine, oak, and chestnut are being replaced by hemlock and members of the maple-beech association in both forests.

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1936. AGE-SIZE RELATIONSHIPS OF HEART'S CONTENT, A VIRGIN FOREST IN NORTHWESTERN PENNSYLVANIA. Ecology 17: 251-257.

Ages, heights, and diameters at breast height of some 800 trees of the principal species were obtained in a study of relationships between d.b.h. (diameter at breast height), age, and height. Good correlation between age and d.b.h. was found for the major species, but dispersion of the data about the average curve was too great to permit accurate estimation of age from d.b.h. Good correlation between height and d.b.h. curves permits estimation of height from d.b.h. with fair accuracy.

* Westveld, M.
1934. TYPE DEFINITIONS BASED ON STATISTICS OF STAND COMPOSITION. Northeast. Forest Expt. Sta. Tech. Note 15. 1 p. New Haven.

Definitions for two spruce types of commercial importance--the red spruce-yellow birch and the red spruce-sugar maple-beech types--were developed from tallies of a represent-

ative block of 30 acres in the red spruce-yellow birch type and of 20 acres in the red spruce-sugar maple-beech type, both located in the White Mountain National Forest.

* Wood, O. M.
1935. FOREST REMOVAL AFFECTS LOCAL CLIMATE AND GROWING CONDITIONS. U. S. Dept. Agr. Yearbook 1935: 206-208.

Studies by the Allegheny Forest Experiment Station indicate that partial cutting is better than clear-cutting because the resulting change in local climate is less severe. Comparisons of wooded and denuded areas showed that wooded areas did not suffer the extremes of light, wind, moisture, and temperature that were found in denuded areas. Measurements of climatic factors were made in both air and soil.

# FOREST SOILS

## GENERAL

* Belotelkin, K. T.
1940. SOIL FREEZING AND FOREST COVER.
Northeast. Forest Expt. Sta. Tech. Note 37. 3 pp., illus. New Haven.

Frost observations at Gale River Experiment Forest during 1937-1940 indicated that forest cover delayed soil freezing prior to snowfall and maintained a good degree of soil permeability when the soil was frozen. The depth and duration of frost was greatest in the poorly drained soils.

Day, Gordon M.
1940. TOPSOIL CHANGES IN CONIFEROUS PLANTATIONS.
Jour. Forestry 38: 646-648.

Soil in 18 softwood plantations in Vermont and New York (4 different species) was found to be markedly different from soil in adjacent open fields or pastures. Blankets of litter (6,000 to 38,000 pounds per acre) controlled erosion well, and rates of water percolation in the plantation soils were twice as high as in open areas. Mull humus was superior to mor in organic content and percolation rate.

* Hough, A. F.
1942. SOILS IN A VIRGIN HEMLOCK-BEECH FOREST ON THE NORTHERN ALLEGHENY PLATEAU. Soil Sci. 54: 335—341, illus.

There was no outstanding difference in the character of virgin forests supported by the three major soil types studied. This is explained by: (1) the adaptability of the species to site differences; (2) the heavy texture of the soil and

abundant, well-distributed precipitation; and (3) the action of climatic and biotic factors that are fully as important as soil in the development of these virgin forests.

* Hough, A. F.
1943. SOIL FACTORS AND STAND HISTORY IN A VIRGIN FOREST VALLEY ON THE NORTHERN ALLEGHENY PLATEAU. Soil. Sci. 56: 19-28, illus.

Studies of stand history and soil characteristics were made in a hemlock-beech, beech-maple, and white pine-hemlock virgin forest in northwestern Pennsylvania. The author concludes that climatic and biotic factors are as important in creating these forest associations as are soil characteristics.

Morey, Harold F.
1929. THE EFFECT OF SOIL ON TREE FORM. U. S. Forest Serv., Serv. Bul. 13 (52): 4-5.

Noting that little has been written on the relation of soil to tree form, the author cites Hilgard's observations of how soil affects form of willow oak, scarlet oak, black oak, and spanish oak. One common feature is that in strongly calcareous soils trees tend to have a more thick-set form; farmers use this as an indication of good soil.

Stewart, G. R.
1933. A STUDY OF SOIL CHANGES ASSOCIATED WITH THE TRANSITION FROM FERTILE HARDWOOD FOREST LAND TO PASTURE TYPES OF DECREASING FERTILITY. Ecol. Monog. 3: 107-145, illus.

Typical soil conditions associated with the growth of hardwood forest, pastures of various grass species, and areas covered with moss and ferns were studied in New York State. On land where the original forest had been replaced with pasture, the change from trees to grass has resulted in a loss of permeability to water, a smaller water-holding capacity, and lessened air space.

Stickel, P. W.
1928. PHYSICAL CHARACTERISTICS AND SILVICULTURAL IMPORTANCE OF PODSOL SOIL. Ecology 9: 176-187, illus.

The author explains the reasons for podsolization of the forest floor and cites chemical and physical characteristics of a podsol soil, by horizons. He believes mull is more desirable. "The controlling factor appears to be soil acidity...

slow decomposition and strongly acid conditions go hand in hand... A tendency toward podsolization can be combatted by opening up the stand and by encouraging the admixture of hardwoods."

Stickel, P. W.
1933. RELATION OF FORESTS TO THE EVAPORATING POWER OF THE AIR. New England Waterworks Assoc. Jour. 47 (3): 229-238, illus.

The evaporating power of the air depends largely upon temperature. Experiments at four paired open-forest plots in the Northeast showed that soil and duff temperatures were lower during most of the year in the forest than in the open. Livingston atmometer bulbs showed that evaporation from duff and soil in the open is considerably greater than under a forest canopy.

Toumey, J. W., and Stickel, P. W.
1925. A NEW DEVICE FOR TAKING MAXIMUM AND MINIMUM SOIL TEMPERATURES IN FOREST INVESTIGATIONS. Ecology 6: 171-178, illus.

In soil wells, horizontal borings are made 2 or 3 feet into the soil. The thermometers are held in wooden rods, which are pushed deep into the borings. The advantage of this method is that the soil where the temperature is taken is not disturbed, and the cost is small in comparison with the use of soil thermographs. The method seems much more accurate than taking temperatures in soil boxes.

* Wood, O. M.
1933. LITTER COVER AND SOIL SURFACE TEMPERATURES, OAK-PINE TYPE. Allegheny Forest Expt. Sta. Tech. Note 3. 1 p. Philadelphia.

Data collected in southern New Jersey under an 80-year-old stand of oak and pine, July 5 to Sept. 17, 1932. Temperatures were taken on exposed soil, under oak leaves, and under black commercial mulch paper. Highest average temperatures were on exposed soil, lowest under oak leaves. There was no direct relationship between air temperature and soil-surface temperature.

Wood, O. M.
1939. THE USE OF "GOOSENECK" AND SIX'S THERMOMETERS FOR MEASURING SOIL TEMPERATURES. Jour. Forestry 37: 421-423, illus.

Description of a homemade device for shaking down the mercury in a gooseneck thermometer; and of a wooden box used to protect the fragile Six's thermometer. The box is placed in a pit in the ground; it is designed so that temperatures can be taken 6 and 12 inches below ground level.

## MYCORRHIZAE

Doak, K. D.
1934. CORTICAL PARASITISM OF CONIFER-SEEDLING ROOTS IN PURE CULTURE BY MYCORRHIZAL AND NON-MYCORRHIZAL FUNGI. (Abstract) Phytopathology 24: 6-7.

A fungus (isolated from roots of Pinus taeda) resembling Rhizoctonia silvestris Melin not only formed the mantle and Hartig' network characteristic of ectotrophic mycorrhizae on P. taeda, P. resinosa, P. strobus, P. rigida, and P. radiata, but also infected the cortex of mother roots. Although the latter type of infection was extensive, roots of P. taeda were not killed after 18 months in culture. Two physiologic strains of Armillaria mellea grown with P. strobus and P. rigida infected the cortices of short roots and mother roots.

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1934. FUNGI THAT PRODUCE ECTOTROPHIC MYCORRHIZAE OF CONIFERS. (Abstract) Phytopathology 24: 7.

In pure-culture syntheses the following combinations of fungi and coniferous seedlings gave typical ectotrophic mycorrhizae: Boletus bicolor with Pinus rigida; B. granulatus with P. strobus and P. taeda; B. eximus with P. taeda; B. brevipes with P. rigida and P. taeda; Boletinus picitis with P. strobus, P. taeda, P. resinosa, and P. rigida; Cantharellus cibarius with P. taeda and P. strobus; Amanita muscaria with P. taeda and P. strobus; B. chromapes with P. taeda; Russula lepida with P. rigida, P. taeda, and P. strobus; and Scleroderma vulgare with P. strobus. The mantle and Hartig' network characterizing this form was demonstrated histologically in each case.

Doak, K. D.
1934. MYCORRHIZAE AND THEIR RELATION TO SHADE TREES.
Natl. Shade Tree Conf. Proc. 10: 99-105.

A fairly detailed discussion of the prevalence, methods of spread, types, and associations of mycorrhizal fungi in reference to shade trees, together with the relations of these fungi to the root tissues of their hosts. There is no proof that mycorrhizae can be beneficial or detrimental under a wide range of conditions. The entire problem of determining where the balance between these organisms lies will require many years of intensive study.

---------- and Cohen, Isadore.
1935. THE FIXING AND STAINING OF LIRIODENDRON TULIPIFERA ROOT TIPS AND THEIR MYCORRHIZAL FUNGUS. Stain Technol. 10: 25-32.

Root tips of Liridendron tulipifera associated with a fungus of the Mycelium radicis group (an endotrophic mycorrhiza) were subjected to several different fixations in which the action of cationic chromium and anionic chromium were compared. Anionic chromium in the form of chromic acid was combined with several substituted benzene compounds while cationic chromium in the form of chromic sulfate in 4 percent formaldehyde was used with the same ring compounds. In addition, several fixatives not containing chromium were tested. Cationic chromium appeared to be superior to anionic chromium in preserving cell walls as well as the general histologic features of the material investigated.

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1936. MYCORRHIZAE OF TREES AND SHRUBS.
Pa. Univ. Morris Arboretum Bul. 1 (4): 45-49, illus.

A summary of the many trees on which mycorrhizae are known and of some of the mycorrhizae-forming fungi; and the complex relationship between the fungus and the host plant. The fungi are known to be beneficial to the host plant under some conditions and detrimental in others. Little is known about physiological relations between fungus and host plant, although the structural relations have been well described.

* Forbes, R. D.
1938. "MIKES"--A BOTANICAL ENIGMA.
Sci. Monthly 46: 32-40, illus.

A discussion of whether mycorrhizae are harmful or beneficial to trees. No definite proof has been found to show

mycorrhizae either harmful or beneficial. The work and techniques now being carried on at the Allegheny Forest Experiment Station to determine the effect of mycorrhizae is outlined.

Hatch, A. B.
1933. TRUE MYCORRHIZAL FUNGUS IN CONTRAST TO MYCELIUM RADICIS ATROVIRENS. (Abstract) Phytopathology 23: 14.

Reports the isolation of mycelium from black mycorrhizae and the results of some experiments with it.

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1933. PURE-CULTURE TECHNIQUE FOR QUANTATIVE STUDIES OF PLANT GROWTH IN ASSOCIATION WITH MICRO-ORGANISMS. (Abstract) Phytopathology 24: 14.

A brief explanation of apparatus and techniques used, and the advantages of the pure-culture technique.

--- and Doak, K. D.
1933. MYCORRHIZAL AND OTHER FEATURES OF THE ROOT SYSTEMS OF PINUS. Jour. Arnold Arboretum 14 (1): 85-98, illus.

Pine root systems consist of long and short (absorbing) roots; the morphological features of each are recited. Three types of long roots are recognized and described: (1) radicles, (2) diarch laterals, and (3) polyarch continuations of the latter. Three kinds of short roots are also recognized: (1) uninfected short roots, (2) infected short roots in which the mycorrhizal structure is absent, and (3) infected short roots that have acquired the mycorrhizal structure and with which true mycorrhizal fungi are associated. Each kind is defined in terms of organography and anatomy.

## SOIL FAUNA

Jacot, Arthur Paul
1936. WHY STUDY THE FAUNA OF THE LITTER? Jour. Forestry 34: 581-583.

Large populations of minute nonmicroscopic animals and insects in the soil help bring about the mechanical reduction of large plant parts to small particles. This permits

more efficient chemical reduction by molds and bacteria. Soil porosity is also improved by fauna channeling and eating dead plant material in the soil. More knowledge is needed as to the exact nature and extent of the feeding action of different classes of fauna.

Jacot, Arthur Paul

1936. TWO UNRECORDED SPECIES OF SCUTACARIDAE FROM THE SOUTHERN APPALACHIANS. Canad. Ent. 68: 225-229, illus.

Previously, the Scutacaridae genera were divided chiefly on the basis of presence or absence of ungual hooks on tarsi I and IV, a nonphylogenic characteristic. The author presents a new key to the genus and describes the species Variatipes pennaticlavarum and V. elongatus, which were found in the Bent Creek Experimental Forest in western North Carolina.

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1936. THREE POSSIBLE MITE VECTORS OF THE DUTCH ELM DISEASE. Ent. Soc. Amer. Ann. 28: 627-635, illus.

During the winter 1934-35 the author studied the fauna of elm bark in lower Westchester County, N. Y. He identifies and describes three mites that may be possible vectors of the Dutch elm disease. They are: Monieziella arborea, Histiogaster fungivorax, and Megninietta ulmi.

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1936. MORE PRIMITIVE MOSS-MITES OF NORTH CAROLINA. Jour. Elisha Mitchell Sci. Soc. 52: 247-253, illus.

A number of species of Oribatidae moss-mites found in North Carolina are described in detail. A limited account is given of the places where they were found.

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1937. TYPES OF FOREST CARPET. Sci. Monthly 44: 558-563, illus.

The author compares the forest floor to a series of carpets that differ in structure. The material of these carpets is derived largely from vegetative depositions of the forest. The weaving is done by the flora and fauna of the forest floor. The differences in structure of these forest carpets are partly accounted for by the variations in the deposited materials, by the land-use history of the area, and by the differences in the nature of the weavers, principally the insects, worms, and fungi.

Jacot, Arthur Paul.

1937. SIX NEW MITES FROM WESTERN NORTH CAROLINA. Ent. Soc. Wash. Proc. 39: 163-166.

A description of mites found in woodland soil and litter in western North Carolina. Similar species are compared and differences noted. Distinguishing characteristics are described in detail.

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1937. NEW MOSS-MITES, CHIEFLY MIDWESTERN. II. Amer. Midland Nat. 18: 237-250, illus.

The author gives diagnostic characteristics and descriptions of a number of species and subspecies belonging to the following genera: Nothrus, Nanhernannia, Hermaniella, Eremobodes, Caraboides, Suctobelbila, Oribella, Gymnoclampia, Porobelba, Liacarus, Xylobates, and Ceratozetes.

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1937. EVOLUTIONARY TRENDS, ECOLOGICAL NOTES, AND TERMINOLOGY OF THE LARGE-WINGED MITES OF NORTH AMERICA. Amer. Midland Nat. 18: 631-651, illus.

Evolutionary changes are traced from primitive genera to more advanced genera such as Zetes and Galumna; the extent of changes and general trends of changes are described. Reproductive habits, geographical distribution, preferred habitat, and food habits are discussed. The author outlines the system of terminology he uses.

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1937. JOURNAL OF NORTH AMERICAN MOSS-MITES. Jour. N. Y. Ent. Soc. 45: 353-375, illus.

The author names and describes species of the family Oribatidae. Studies of certain genera reveal that holarctic species have notogastral bristles occupying the same relative positions in each of the subspecies. Subspecific differences are the development of chitinous ridges and spurs rather than stability of position of the bristles.

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1938. NEW MOSS-MITES, CHIEFLY MIDWESTERN. III. Amer. Midland Nat. 19: 647-657, illus.

A technical report describing and naming 16 new moss-mites. Descriptions of the anatomical details are given for

each new species or subspecies. The paper is based mainly on specimens from Carle-Woods, Evanston, Ill.

Jacot, Arthur Paul.

1938. FOUR NEW ARTHROPODS FROM NEW ENGLAND.
Amer. Midland Nat. 20: 571-574, illus.

A millipede of the genus Fontaria is described and named Fontaria lutzi in honor of Harold J. Lutz, professor of forest soils at Yale University. The Arrhopalites whitesidei, named after Jack Whiteside, was found in Branford, Conn. The species is described and illustrated. Two other species of mites from spruce litter samples in the Gale River Experimental Forest, Coccorchestes humicolus and Adoristes ovatus ammonoosuci, are described and illustrated.

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1938. THE GEENTON MITES OF FLORIDA.
Fla. Ent. 21: 49-57, illus.

Descriptions of additional Geenton mites recently discovered. The author lists the species and their classifications and habitats.

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1938. MORE BOX-MITES OF THE NORTHEASTERN UNITED STATES.
Jour. N. Y. Ent. Soc. 46: 109-145, illus.

A description of some newly discovered box-mites of the northeastern United States. The author describes and classifies these box-mites and tells of their life habits and preferred habitats.

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1938. THOMAS SAY'S FREE-LIVING MITES REDISCOVERED.
Psyche 45: 121-132, illus.

Thomas Say, the first American to record mites found in the United States, described six species of free-living mites from eastern Georgia and Florida. In this same area Jacot collected mites and compared his findings with Say's. He describes several species of mites in detail, analyzing each by diagnostic characters, and telling where each was found.

Jacot, Arthur Paul.

1938. SOME NEW WESTERN NORTH CAROLINA MOSS-MITES. Ent. Soc. Wash. Proc. 40: 10-15.

A census of the fauna of the litter of hardwood forests in Bent Creek watershed in western North Carolina revealed 18 species and subspecies of Oribatidae. The types, deposited at the United States National Museum, are described and classified.

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1938. MORE PRIMITIVE MOSS-MITES OF NORTH CAROLINA. III. Jour. Elisha Mitchell Sci. Soc. 54: 127-137, illus.

Supplements on earlier article (1936) about primitive moss-mites of North Carolina with descriptions of more species of Oribatidae. The three genera of Parhypochthoniinae are segregated. The key to genera of Palaecarini is found by noting the number of transverse folds in the dorsum of abdomen.

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1938. A PSEUDOGARYPIN PSEUDOSCORPION IN THE WHITE MOUNTAINS. Boston Soc. Nat. Hist. Occas. Papers 8: 301-303, illus.

A related species of the genus Pseudogarypus, heretofore observed only west of the Rocky Mountains in the United States, was discovered on the spruce flats of the White Mountains. This species, Garypus bicornis Banks, was named after Nathan Banks. A detailed description of the species is given.

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1939. REDUCTION OF SPRUCE AND FIR LITTER BY MINUTE ANIMALS. Jour. Forestry 37: 858-860, illus.

Spruce litter is reduced to humus by the action of fungi, animals, and possibly bacteria. In studies at the Gale River Experimental Forest in New Hampshire, spruce and fir litter was found to be reduced by the immature stages of three species of saprophagous mites: Hoplophorella thoreaui, Phthiracarus boresetosus, and Adoristes ovatus ammonoosuci. These minute animals eat the needles from the inside after fungal action has softened them. A species of midge (Sciara) was also found within the needles, but it may be a secondary saprophyte.

Jacot, Arthur Paul.
1940. NEW ORIBATID MITES FROM SOUTH AFRICA.
Ann. Natal Mus. 9 (3): 391-400, illus.

Detailed descriptions of 14 mites, all belonging to the family Oribatidae (in the broad sense). The specimens described are part of the collections of the Natal Museum, Pietermaritzburg, and the South African Museum, Cape Town.

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1940. THE FAUNA OF THE SOIL.
Quart. Rev. Biol. 15 (1): 28-58.

A comprehensive summary of the effect on soil of all types of animals, from mammals to mites. Based on 20 years' investigations (the author died while this article was going to press), this article deals chiefly with the effect of fauna on forest soils. The author points out that appallingly little is known of the invertebrates that inhabit mesophytic woodland soils in the Northeastern States. But, he says, "soil improvement must take into consideration the soil fauna...man can bring about optimum (soil) conditions by enlightened management. He can not only direct, but hasten nature's processes: (1) by eliminating chance and (2) by using short cuts, and especially (3) by giving the forest complex the right start."

# FOREST MANAGEMENT AND SILVICULTURE

## GENERAL

Dana, Samuel T.
1930. TIMBER GROWING AND LOGGING PRACTICE IN THE NORTHEAST. U. S. Dept. Agr. Tech. Bul. 166. 122 pp., illus.

Outlines the forest situation in New England, New York, Pennsylvania, and New Jersey, with data on forest areas, regions, types, and logging practices. The need for keeping forests fully productive is stressed, and plans are offered for forest types.

Dorman, Keith W., and Sims, Ivan H.
1949. LOBLOLLY PINE BIBLIOGRAPHY. Southeast. Forest Expt. Sta. Paper 6. 65 pp. Asheville, N. C.

A collection of references, prepared as a guide and timesaver in Forest Service experimental work. References are listed by subject matter and author. Author index included.

Harper, V. L., and Rettie, James C.
1946. THE MANAGEMENT STATUS OF FOREST LANDS IN THE UNITED STATES. REPORT 3 FROM A REAPPRAISAL OF THE FOREST SITUATION. U.S. Forest Service. 29 pp., illus. Washington, D. C.

Factual analysis of the quality of forest management on the commercial forest lands of the United States. Forest management was rated by five levels of cutting practice (from high order to destructive) and on effectiveness of fire protection. Only 57 percent of public forest lands and 28 percent of private holdings (5,000 acres or more) are being operated on sustained-yield basis. Of 461 million acres of

commercial forest land, only 33 percent rate fair to good extensive management, only 2 percent rate intensive management. The small holdings, both farm and nonfarm, show least progress toward good timber management.

Harper, V. L., and Mason, I. J.
1947. COMMENT. (About article on U. S. Forest Service reappraisal, by G. A. Pearson) Jour. Forestry 45: 910-911.

The authors frankly admit inadequacies in the criteria used for judging forest management in the Forest Service's reappraisal. However, they say these were the best practical criteria that could be applied on a Nation-wide basis.

Hough, A. F.
1933. VIRGIN FOREST IN PENNSYLVANIA YIELDS RESEARCH RESULTS. U. S. Forest Serv. Forest Worker 9 (2): 11.

Description of a virgin hemlock-hardwood stand in the Allegheny National Forest and the factors to be considered in planning management of such a forest.

* Jensen, Victor S.
1943. SUGGESTIONS FOR MANAGEMENT OF NORTHERN HARDWOOD STANDS IN THE NORTHEAST. Jour. Forestry 41: 180-185, illus.

The author recommends (1) complete clear-cutting of areas where mature or overmature trees make up most of the stand; (2) the restriction of clear-cutting to groups of inferior trees in stands containing a large proportion of promising trees; and (3) partial cutting of scattered individuals or small groups of trees in old-growth stands that have previously been opened up to such an extent that immature even-aged groups have taken over any considerable part of the area. Mowing and weeding of young stands are questionable. Thinning may prove worth while, particularly if the products are salable.

Morey, H. F.
1939. RESEARCH PROBLEMS IN THE MANAGEMENT OF NORTHERN WHITE PINE IN NORTHEASTERN UNITED STATES. Iowa State Col. Ames Forester 1939: 41-47, illus.

Brief description of the white pine region in the Northeast, its general forest-type associations, and the economic importance of the species to the region. The research

problems are both silvicultural and economic, and the author outlines a method of approach.

* Westveld, Marinus.
1930. PULP-WOOD CROPS IN THE NORTHEAST. U. S. Dept. Agr. Leaflet 57. 8 pp., illus.

Suggested methods for managing spruce lands for continuous, profitable crops of pulpwood. The author describes methods of cutting pure softwood stands and mixed hardwood-softwood stands, girdling unprofitable hardwoods, cleanings at regular intervals, and disposing of slash.

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1930. SUGGESTIONS FOR THE MANAGEMENT OF SPRUCE STANDS IN THE NORTHEAST. U. S. Dept. Agr. Cir. 134. 23 pp., illus.

The author recommends cutting practices and cultural methods for maintaining the various spruce types of the region in a productive condition. He emphasizes the importance of classifying spruce lands as to inherent capacity for spruce growth, as a basis for deciding whether spruce can be encouraged to predominate.

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1930. SPRUCE REGENERATION IN EASTERN CANADA AND NORTHEASTERN UNITED STATES. Forestry Chron. 7 (1): 22-23, illus.

The author reviews the spruce-fir forests, their history, importance to the pulp and paper industry, the forest types, and silvicultural problems involved in maintaining pulpwood production on the potential pulpwood lands of the region. The major problem is to formulate cultural practices to protect and develop the already existing stands of reproduction.

---------- and others.
1939. THE RELATION OF STAND COMPOSITION TO CROP SECURITY. Jour. Forestry 37: 49-54.

A report by the committee on silviculture, New England Section, Society of American Foresters, recommending that the climax forest should always be used as a guide to a workable combination of species, but that modifications may be used to get the greatest return and still insure crop security.

Westveld, Marinus, and others.
1941. A SILVICULTURAL POLICY FOR THE HURRICANE AREA. Jour. Forestry 39: 376-378.

The authors discuss the silvicultural problems involved in rehabilitating the forests destroyed by the 1938 hurricane in New England. They recommend chief dependence be placed on natural regeneration and on the protection of the remaining growing stock and young growth. Later--in probably 5 years--supplementary stocking (through planting) and weeding and similar treatments should be considered.

* ---------- and others.
1941. RECOMMENDED FOREST PRACTICE FOR NEW ENGLAND. Forestry Chron. 17 (4): 155-161.

A report of the committee on silviculture, New England Section, Society of American Foresters, outlining recommended forest practices that the committee feels are the minimum rules needed for preventing further needless destruction and deterioration of New England's forests. Measures are recommended for each of the forest types found in New England.

---------- and others.
1944. RECOMMENDED FOREST PRACTICE STANDARDS FOR NEW ENGLAND. Jour. Forestry 42: 716-723.

A report by the committee on silviculture, New England Section, Society of American Foresters, presenting a set of forest-practice standards for the major forest types in New England. Included are descriptions of each forest region and a brief account of the factors responsible for present conditions.

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1945. SILVICULTURAL PROBLEMS OF EASTERN CANADA'S PULPWOOD FORESTS AS VIEWED BY AN AMERICAN FORESTER. Canad. Pulp and Paper Assoc. Woodlands Sect. Index 756 (F-2): 4 pp.

The author analyzes the silvicultural problems of the spruce-fir forests, the main source of raw materials for the pulp and paper industry, and presents a comprehensive program of research aimed at solving these problems. He emphasizes the need for coordinated research in the field of spruce-fir management, with close cooperation between Canadian and United States research agencies.

Westveld, Marinus.
1945. SILVICULTURAL PROBLEMS OF EASTERN CANADA'S PULPWOOD FORESTS AS VIEWED BY AN AMERICAN FORESTER. Pulp and Paper Mag. Canada 46: 332-334, 337.

See above.

## SILVICAL CHARACTERISTICS

## OF TREE SPECIES

Downs, Albert A., and McQuilkin, William E.
1944. SEED PRODUCTION OF SOUTHERN APPALACHIAN OAKS. Jour. Forestry 42: 913-920, illus.

The management of oak stands requires an understanding of the seeding habits of individual species, the productiveness of trees of different sizes, and the importance of biotic factors in reducing the number of acorns available for germination. Seven years' records of seed production for five species of oak at two locations in the southern Appalachian region are presented; and silvicultural implications and minimum standards of cutting are suggested.

Gast, P. R.
1930. A THERMOELECTRIC RADIOMETER FOR SILVICAL RESEARCH, WITH PRELIMINARY RESULTS ON THE RELATION OF INSOLATION TO THE GROWTH OF WHITE PINE. Harvard Forest Bul. 14. 76 pp., illus.

The author describes an apparatus for recording total radiation. He cites several years' observations with this radiometer in white pine plantations to show that deviations in growth over and above those due to seasonal water supply are due to total radiant energy.

* Hough, A. F.
1943. NORWAY SPRUCE FOR PULPWOOD. Jour. Forestry 41: 66-68.

A survey of many of the Norway spruce plantations in the Northeastern States indicates that this species can be profitably grown for pulpwood. These plantations seem to thrive on moist, well-drained, sandy loam soils; they grow poorly or fail altogether on dry, shallow soils and on areas of poorly drained clayey soils.

Huberman, M. A.
1942. GOLDEN RAIN ON NEW ENGLAND.
Nature Mag. 35: 149-150, illus.

In 1941 Nature--as though in repentance for the havoc wrought by the 1938 hurricane--provided a bumper crop of white pine seed in New England. The author suggests that, in cutting timber, woodlot owners leave seed trees to reforest their land.

Jensen, Victor S., and MacAloney, Harvey J.
1949. RECOVERY OF BIRCH FIFTEEN YEARS AFTER PARTIAL CUTTING. Soc. Amer. Foresters Proc. 1948: 298-302.

A description of changes in environment and stand development after a partial cutting in the White Mountain National Forest, New Hampshire. Post-logging decadence became evident the second season after cutting. Changes in the treated stand were less evident in succeeding years as the canopy closed again. At the end of the 15-year period the trees in the treated stand appeared to be recovering from post-logging decadence.

Little, Silas, Jr.
1938. RELATIONSHIPS BETWEEN VIGOR OF RESPROUTING AND INTENSITY OF CUTTING IN COPPICE STANDS. Jour. Forestry 36: 1216-1223.

A study to determine relationship between vigor of resprouting and intensity of cutting in coppice stands (white oak, black oak, scarlet oak, chestnut oak, post oak) showed inherent differences in sprout behavior among species. Even a light cutting to encourage immediate seedling reproduction may prove ineffective because of the rapidity with which sprouts fill openings.

* ----------
1940. SEED FALL OF ATLANTIC WHITE-CEDAR.
Allegheny Forest Expt. Sta. Tech. Note 26. 1 p. Philadelphia.

In the pine barrens of southern New Jersey seed dispersal began about October 15 and continued during each month of the year; 39 percent of the seed crop fell by November 15 and 60 percent by December 15.

* Little, Silas Jr.
1940. SEED FALL OF SHORTLEAF PINE.
Allegheny Forest Expt. Sta. Tech. Note 27. 1 p. Philadelphia.

In the pine barrens of southern New Jersey during 1936-39, seed fall began in the last half of October, a week or so after the first frost, and continued until April. Heaviest seed fall was in November. Rain (and possibly high relative humidities) reduced seed dispersal.

* McClennen, F. H., Jr.
1939. FURTHER NOTES ON SEED PRODUCTIVITY OF CHESTNUT OAK IN SOUTHERN NEW JERSEY. Allegheny Forest Expt. Sta. Tech. Note 24. 2 pp. Philadelphia.

Two similar chestnut oak trees showed notable differences in seed productivity during a 10-year period, tending to support an earlier theory that certain trees produce good seed crops at regular intervals while others comparable in size and age never produce good crops.

McIntyre, A. C., and Schnur, G. Luther.
1936. EFFECTS OF DROUGHT ON OAK FORESTS.
Pa. Agr. Expt. Sta. Bul. 325. 43 pp., illus.

The effects of the extreme drought year 1930 on the species composition and growth of individual trees were studied in four different forest types in central Pennsylvania. Conifers suffered greater losses than hardwoods, with the exception of scarlet and black oak. Red, white, and chestnut oak were found to be the most drought-resistant. Of the four types studied (chestnut oak, hemlock, scarlet oak-black oak, and white pine-chestnut oak-chestnut) losses were smallest in the chestnut oak type, both in basal area and number of trees.

McLintock, Thomas F.
1948. EVALUATION OF TREE RISK IN THE SPRUCE-FIR REGION OF THE NORTHEAST. Iowa State Col. Jour. Sci. 22: 415-419.

A simple scale (based on crown class, crown ratio, and tree vigor) for use in estimating the relative vulnerability of red spruce and balsam fir to the spruce budworm. This method was designed as a working tool and guide for practicing foresters and timberland owners who mark spruce and fir for selective cutting.

* McLintock, Thomas F.
1948. EVALUATION OF TREE RISK IN THE SPRUCE-FIR REGION OF THE NORTHEAST. Northeast. Forest Expt. Sta. Paper 16. 7 pp. Upper Darby.

See above.

McQuilkin, W. E.
1935. ROOT DEVELOPMENT OF PITCH PINE, WITH SOME COMPARATIVE OBSERVATIONS ON SHORTLEAF PINE. Jour. Agr. Res. 51: 983-1016, illus.

The root system developed by pitch pine in southern New Jersey was studied in dry excavations, and changes in root system with increasing age are described. Some comparative observations were made on the root systems developed by shortleaf pine on the same upland site and by pitch pine on heavier or wetter soils. Extensive root growth by pitch pine was noted below the water table in saturated soils.

* Mollenhauer, Wm., Jr.
1939. TABLE MOUNTAIN PINE--SQUIRREL FOOD OR TIMBER TREE? Jour. Forestry 37: 420-421, illus.

Table mountain pine is known in some parts of Pennsylvania as "squirrel pine" because red squirrels gnaw through the limbs, apparently to drop the cones to the ground, where they can be easily opened. If it were not for the squirrels, this species might be valuable as a timber tree.

* Morey, H. F.
1935. THE AVERAGE DATE OF MATURITY OF WHITE PINE (PINUS STROBUS L.) SEED. Northeast. Forest Expt. Sta. Tech. Note 22. 1 p., illus. New Haven.

Chart based on 5-year observations in New England. Maturity dates charted ranged from August 1 in northern Connecticut to September 15 in Vermont, New Hampshire, and southern Maine.

Schnur, G. Luther
1932. MORTALITY IN OLD FIELD LOBLOLLY PINE. U. S. Forest Serv. Forest Worker 8 (3): 7, illus.

Loblolly pine seeded in abundantly on test plots in old fields on the Eastern Shore of Maryland. Mortality was great during the first 10 years (68 percent between the ages of 5 and 10 years), then tapered off. The total loss between

the ages of 5 and 25 years was 92 percent; between 25 and 50 years mortality decreased steadily, totaling only 5 percent.

Shirley, Hardy L., and Zehngraff, Paul.
1942. HEIGHT OF RED PINE SAPLINGS AS ASSOCIATED WITH DENSITY. Ecology 23: 370.

On the Chippewa National Forest, Minnesota, studies in red pine 16-18 years old indicated that 37 percent of the variation in height is due to spacing or factors associated with spacing. Where the spacing was wide, approximately 20 x 20 feet, the average height was 5.5 feet; where it was as close as 5 x 5 feet, the average height was 14 feet.

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1943. IS TOLERANCE THE CAPACITY TO ENDURE SHADE? Jour. Forestry 41: 339-345.

Many misleading concepts have arisen as a result of broadening the usage of the term "tolerance". The author recommends that use of the unqualified term "tolerance" be discontinued, and that the term "shade tolerance" be used to denote the capacity of a tree species to survive in light of low intensity.

* ----------
1945. LIGHT AS AN ECOLOGICAL FACTOR AND ITS MEASUREMENT. II. Bot. Rev. 11: 497-532.

A review of studies of light as an ecological factor, covering work performed since 1935 and reported in some 186 published reports. The author discusses methods of light measurement and sources of errors. Various components of light climate are given and their effects upon vegetal growth are described. Light requirements for photosynthesis are reviewed. The interrelationship between light and other factors such as temperature, mineral nutrition, water relations, growth, form, and the relationship between light and succession, is discussed.

Snow, Albert G., Jr.
1938. SEED CROP REPORT FOR FOREST TREES IN THE NORTHEAST, 1938. Northeast. Forest Expt. Sta. 8 pp., illus. New Haven.

A report on the seed crop in the Northeast in 1938; it lists 55 species, the general character of the seed crop, and the season the seed matures.

Snow, Albert G., Jr.
1940. SEED CROP REPORT FOR FOREST TREES IN THE NORTHEAST, 1940. Northeast. Forest Expt. Sta. 22 pp., illus. New Haven.

A report on the seed crop in the Northeast in 1940; it deals with 40 species and indicates the character of the seed crop. Individual maps for most species indicate the character and location of the prospective crop.

Westveld, M.
1945. A SUGGESTED METHOD FOR RATING THE VULNERABILITY OF SPRUCE-FIR STANDS TO BUDWORM ATTACK. Northeast. Forest Expt. Sta. 4 pp. Philadelphia.

Spruce-fir stands vary in degree of vulnerability to spruce budworm; this vulnerability is associated with age and the proportion of fir in the stand. On the assumption that basal area of balsam fir is a more accurate measure of vulnerability than diameter, the author suggests a formula for rating vulnerability: $S = V \times BA$ in which S is the susceptibility rating, V is the balsam fir volume in cords per acre, and BA is the basal area of the average balsam fir at breast height (3.1416 x radius squared, in inches).

* Wood, O. M.
1930. WINDFIRMNESS OF HEMLOCK LEFT AFTER LOGGING. Allegheny Forest Expt. Sta. Tech. Note 2. 2 pp., illus. Philadelphia.

Two years after a heavy cutting for chemical wood in Elk County, Pa., a tally was made of all stumps, standing trees, and windfalls on seven 1/2-acre plots. Contrary to expectations, only a small percentage of the hemlock left standing subsequently blew down.

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1932. AN EXAMPLE OF WHITE PINE REPRODUCTION ON BURNED LANDS IN NORTHEASTERN PENNSYLVANIA. Jour. Forestry 30: 838-845, illus.

From a group of 11 white pines that had survived logging and subsequent fires, strips were run in the 4 cardinal directions. The amount of white pine reproduction was less at greater distances from the seed trees and was greatest on the east strip, least on the west strip. Establishment of reproduction was greatest 7 to 9 years after the last fire and has declined steadily since then, probably because of unfavorable seedbed conditions.

Wood, O. M.

1933. ACORNS FROM THE SAME TREE TEND TO BE UNIFORM. U. S. Forest Serv. Forest Worker 9 (4): 11.

A sample of acorns from one chestnut oak tree in southern New Jersey was weighed. More than 80 percent weighed between 5.6 and 8.5 grams. From casual observation it is apparent that each tree bears acorns of a distinctly uniform shape.

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1934. THE ROOT SYSTEM OF A CHESTNUT OAK (QUERCUS MONTANA WILLD.). Natl. Shade Tree Conf. Proc. 10: 95-98.

This study of the root system of a chestnut oak in the coastal plain of New Jersey revealed that roots comprised 45 percent of the total dry weight of the tree. The area of root spread was 10 times as great as the crown spread.

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1934. A BRIEF RECORD OF SEED PRODUCTIVITY FOR CHESTNUT OAK IN SOUTHERN NEW JERSEY. Jour. Forestry 32: 1014-1016.

Because of the scarcity of oak seedlings in the New Jersey pine barrens, a survey of the seed-producing capacity of 55 chestnut oaks was made during 3 successive years. Productivity varied greatly among apparently similar trees, and among productive trees from year to year.

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1937. THE FALL OF SHORTLEAF PINE SEED IN SOUTHERN NEW JERSEY. Allegheny Forest Expt. Sta. Tech. Note 18. 1 p. Philadelphia.

The greatest seed fall occurred in November, although some seed was caught as late as May 1. No seed was caught before the first killing frost.

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1938. SEEDLING REPRODUCTION OF OAK IN SOUTHERN NEW JERSEY. Ecology 19: 276-293, illus.

Although enough viable seed is produced over a period of years to provide a crop of seedlings, much of the seed is destroyed by animals or insects. The remaining seed may not produce established seedlings because of: too much or too little soil cover or litter, drought, soil acidity, infertility of the soil, and overwood shade and competition.

* Wood, O. M.
1938. SEED DISPERSAL OF SOUTHERN WHITE CEDAR. Allegheny Forest Expt. Sta. Tech. Note 21. 2 pp. Philadelphia.

In the Lebanon Experimental Forest in New Jersey, the greatest amount of seed was caught in November, but some seed was still falling as late as August 12. The greatest fall occurred during periods of high wind when there was no precipitation.

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1939. PERSISTENCE OF STEMS PER SPROUT CLUMP IN OAK COPPICE STANDS OF SOUTHERN NEW JERSEY. Jour. Forestry 37: 269-270.

In coppice stands the tendency of stems to grow outward to escape crowding results in poor form. Of nearly 3,000 sprout clumps mapped in a 13-year-old stand, post oak had the greatest relative number of one-stem clumps; then black oak, chestnut oak, white oak, and scarlet oak.

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1939. RELATION OF THE ROOT SYSTEM OF A SPROUTING STUMP IN QUERCUS MONTANA WILLD. TO THAT OF AN UNDISTURBED TREE. Jour. Forestry 37: 309-312, illus.

The root systems of an undisturbed tree and of the sprouting stump of a comparable tree were excavated and compared. Although the data are limited to two trees, they indicate that some of the root system dies immediately after the parent tree is cut.

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1939. REPRODUCTION OF SHORTLEAF PINE FOLLOWING MECHANICAL TREATMENT OF THE SEEDBED. Jour. Forestry 37: 813-814.

In most shortleaf pine-oak stands in New Jersey, reproduction of the pine is characteristically scarce. It was found that natural seeding of the pine was improved only slightly by raking over the ground, but that it was greatly increased by digging or scalping.

# STAND IMPROVEMENT

* Burnham, C. F., Ferree, M. J., and Cunningham, F. E.
1947. THE NORTHERN HARDWOOD FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 1. 31 pp., illus. Philadelphia.

The northern hardwoods are the most important forest type in the Anthracite Region of Pennsylvania, but are in very poor condition because of heavy cutting. These present conditions are described, and silvicultural treatments are suggested.

* ---------- Ferree, M. J., and Cunningham, F. E.
1947. THE RED OAK-WHITE OAK FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 2. 33 pp., illus. Philadelphia.

Fire and clear-cutting for mine timbers have reduced this forest type in Pennsylvania's Anthracite Region so that only 2.8 percent of the 915,200 acres it covers can be classed as saw-timber areas. Silvicultural treatments for improving this forest type are suggested.

---------- Ferree, M. J., and Cunningham, F. E.
1947. THE SCRUB OAK FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 4. 9 pp., illus. Philadelphia.

Worthless scrub oak covers large areas in the Anthracite Region of Pennsylvania. The authors attribute much of this condition to repeated fires. They believe that scrub oak areas will naturally revert to more valuable tree species if fires can be kept out.

---------- Ferree, M. J., and Cunningham, F. E.
1947. THE ASPEN-GRAY BIRCH FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 7. 20 pp., illus. Philadelphia.

In their present condition these forests make practically no contribution to the supply of lumber and mine props needed in Pennsylvania's Anthracite Region. They occur generally where northern hardwood forests have been burned over after logging. Thinning and planting will probably be needed to convert them to productive forests.

Burnham, C. F., Ferree, M. J., and Cunningham, F. E.
1947. THE WHITE PINE-OAK FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 8. 35 pp., illus. Philadelphia.

The white pine-oak forests occupy a fifth of the forested area in Pennsylvania's Anthracite Region, but because of heavy cutting and fires they are in very poor condition. Measures needed to improve the productivity of these forests, and especially to increase the dwindling proportion of white pine, are suggested.

---------- Ferree, M. J., and Cunningham, F. E.
1947. THE CHESTNUT OAK FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 9. 28 pp., illus. Philadelphia.

The chestnut oak forests occur mostly on poor ridge sites in Pennsylvania's Anthracite Region, often in inaccessible places; they contain some saw timber and mine timber but most of the stands are of seedling and sapling size. Although these forests are of little commercial value, they serve to protect watersheds. Present conditions are described, and measures to improve productivity are suggested. Fire protection is essential.

---------- Ferree, M. J., and Cunningham, F. E.
1947. THE WHITE PINE-HEMLOCK FORESTS OF THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 11. 25 pp., illus. Philadelphia.

White pine-hemlock forests, found chiefly on well-drained slopes and along ravines, occupy less than 8 percent of the forest area in the Anthracite Region of Pennsylvania, but they contain 29 percent of the volume in saw-timber stands. Still they produce only half of what they could. Silvicultural treatments to improve the stands and to increase the proportion of white pine are suggested.

Campbell, W. A.
1938. PRELIMINARY REPORT ON DECAY IN SPROUT NORTHERN HARDWOODS IN RELATION TO TIMBER STAND IMPROVEMENT. Northeast. Forest Expt. Sta. Occas. Paper 7. 8 pp. New Haven.

Since practically all of the northern hardwoods (except beech) are vigorous sprouters, stump decay must be considered in stand improvement. Size of stump and height of

sprout origin are directly related to the size of wound left by the decaying stump. If the wound heals in 25-35 years, decay hazard is much less. Decay in root system had little effect on decay in sprouts. No one fungus seemed responsible for decay. The species studied, in order of resistance to butt infection: white ash, black cherry, sugar maple, basswood, paper birch, and red maple.

* Campbell, W. A., and Spaulding, Perley.
1942. STAND IMPROVEMENT OF NORTHERN HARDWOODS IN RELATION TO DISEASES IN THE NORTHEAST. Allegheny Forest Expt. Sta. Occas. Paper 5. 34 pp., illus. Philadelphia.

On the better sites and in stands where the canker and rot diseases are not chronic, stand-improvement measures such as removing diseased trees, sprout clumps, and trees of poor form will improve the quality and growth of the stand. The important diseases are described briefly, and a table of cull deductions is offered as an aid in cruising.

Cline, A. C., and MacAloney, H. J.
1931. A METHOD OF RECLAIMING SEVERELY WEEVILED WHITE PINE PLANTATIONS. Mass. Forestry Assoc. Bul. 152. 12 pp., illus.

Severely weeviled plantations need not be a total loss. Recommendations made by the authors give promise of a yield of 200 to 300 choice 16-foot butt logs per acre. Treatments described include crop-tree selection, pruning, and releasing.

* ---------- and MacAloney, H. J.
1933. ADDITIONAL NOTES ON THE IMPROVEMENT OF WEEVILED WHITE PINE PLANTATIONS. Conn. Forest and Park Assoc. Pub. 24. 12 pp., illus.

In many sections of central and southern New England it is often difficult to locate a sizable white pine that has escaped attack by the white pine weevil. The authors show, however, that the deformities caused by such attacks can be reduced materially by (1) confining the larval activity to the topmost joint before the larvae can tunnel down to the second joint, and (2) avoiding the formation of forks by removing the undesired stems while they are still small.

Cline, A. C., and MacAloney, H. J.
1935. PROGRESS REPORT OF THE RECLAMATION OF SEVERELY WEEVILED WHITE PINE PLANTATION. Jour. Forestry 33: 932-935, illus.

Observations over 4-year period show that the pruned trees are improving. Most of the girdled trees have died, and the stand has been opened gradually. The method has worked out satisfactorily.

* Condit, G. R., Huberman, M. A., and McGuire, John R.
1941. COLLECT THE BOUNTY ON YOUR WOLF-TREES. Northeast. Forest Expt. Sta. Tech. Note 45. 2 pp. New Haven.

If there were a bounty for getting rid of "wolf-trees", every farmer could improve his woodlot and make more room for fast-growing straight young trees. A study of the costs of removing wolf trees showed that they can be marketed for boxboard logs and fuel wood; and a profit can usually be made, certainly if the farmer does his own woods work.

* ---------- Huberman, M. A., and McGuire, John R.
1942. COLLECT THE BOUNTY ON YOUR WOLF-TREES. Jour. Forestry 40: 680-682, illus.

See above.

* Filip, Stanley M.
1949. THINNING YOUNG OAK STANDS FOR SMALL MINE TIMBERS--AT A PROFIT. Northeast. Forest Expt. Sta. Paper 28. 13 pp., illus. Upper Darby.

Under good cutting practice, young oak stands in the Anthracite region of Pennsylvania could be built up by thinnings, and the thinnings would provide salable mine timbers. A thinning study is described, and the author suggests a cut of about 50 percent of the volume. As a guide to different intensities of thinning, he offers a scale of spacing for the trees to be left.

Hough, A. F.
1937. WHY TIMBER STAND IMPROVEMENT? Jour. Forestry 35: 813-822, illus.

Thousands of acres of second-growth hardwood forests in the East are sorely in need of timber-stand improvement. The defects are divided into two main categories: (1) bole-form defects such as crook, forking, lean, and low limbs;

and (2) pathological defects such as Nectria canker, heart rot, etc. The author suggests silvicultural treatments that will tend to reduce the fairly high proportion of trees with such injuries.

* Hough, A. F.
1938. RECOMMENDED TIMBER STAND IMPROVEMENT PRACTICES IN NORTHERN HARDWOODS-HEMLOCK ON THE ALLEGHENY PLATEAU. Allegheny Forest Expt. Sta. Occas. Paper 1. 16 pp. Philadelphia.

As a result of fire and past cutting practices, these stands are in one of two general conditions: (1) understocked, lacking trees of desirable species and form, or (2) overcrowded, with defective trees and weed species. These stands can be rehabilitated by fire protection and weeding in young growth; thinning, liberation, improvement, sanitation, and salvage cuttings in second growth; and improvement, liberation, and harvest cutting in old growth. The author recommends ways of doing this.

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1946. IMPROVEMENT OF SECOND GROWTH NORTHERN HARDWOODS BY CORDWOOD THINNINGS. Northeast. Forest Expt. Sta. Forest Management Note 1. 4 pp. Philadelphia.

Thinnings in well-stocked 40 to 50-year-old second-growth northern hardwoods on good sites resulted, in 2 to 4 years, in a periodic volume growth of 1.4 to 1.8 cords per acre per year. This is compared with untreated stands that continued to grow at the rate of 1.0 to 1.2 cords per acre per year. The author offers condensed rules for making thinnings.

* ---------- and Taylor, R. F.
1946. RESPONSE OF ALLEGHENY NORTHERN HARDWOODS TO PARTIAL CUTTING. Jour. Forestry 44: 30-38.

A 10-year sample-plot study at Kane Experimental Forest indicated that thinning in 40-year-old Allegheny hardwoods stimulates growth of residual trees. Vigor-1 sugar maple, red maple, and beech showed the best response. Black cherry was not stimulated. Yellow birch declined after thinnings. A growth-prediction device is suggested.

* Jensen, Victor S.
1935. SUGGESTIONS FOR WEEDINGS IN NORTHERN HARDWOODS. Northeast. Forest Expt. Sta. Occas. Paper 3. 13 pp., illus. New Haven.

Weedings should be considered seriously in any intensive silvicultural improvement work in northern hardwoods, particularly on better sites and more accessible areas. If the work is properly planned and organized, weeding will compare favorably, in costs and benefits, with other types of cultural work. The author offers suggestions for selecting crop trees, when to weed, selecting stands to be weeded, and organizing work crews.

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1940. RESULTS OF THINNING AND ITS EFFECT ON RESIDUAL YELLOW BIRCH AND ASSOCIATED HARDWOODS SPECIES. Northeast. Forest Expt. Sta. Tech. Note 33. 4 pp. New Haven.

Results of a thinning experiment carried out in a northern hardwood stand on the Bartlett Experimental Forest in New Hampshire. Discusses the effect of thinning on climatic conditions, reproduction, growth rates of seedlings and saplings and residual trees, and condition of the residual trees for a few years after cutting.

* Little, S., and Moore E. B.
1945. CONTROLLED BURNING IN SOUTH JERSEY'S OAK-PINE STANDS. Jour. Forestry 43: 499-506, illus.

Judiciously used, controlled burning provides an economical means for preparing seedbeds for establishment of pine reproduction, for controlling unwanted hardwoods in established pine stands, and for reducing fuel accumulations. It greatly reduces the risk of disastrous conflagrations in times of high fire danger.

* ---------- Allen, J. P., and Moore, E. B.
1948. CONTROLLED BURNING AS A DUAL-PURPOSE TOOL OF FOREST MANAGEMENT IN NEW JERSEY'S PINE REGION. Jour. Forestry 46: 810-819, illus.

A summary of the experience and research in using controlled fires in the pine region of southeastern New Jersey both to protect large blocks of forest land from devastating wild fires and to favor the reproduction of pines instead of less valuable hardwoods. The authors believe that

controlled burning is the key to forest management on upland sites in the New Jersey pine region.

* Little, S., Allen, J. P., and Somes, H. A.
1948. MORE ABOUT THE TECHNIQUE OF PRESCRIBED BURNING. Northeast. Forest Expt. Sta. 4 pp. Upper Darby.

The costs of prescribed burning were reduced in New Jersey from 37 cents an acre in 1946-47 to 22 cents an acre in 1947-48. The authors believe further cost reductions are possible--mainly through careful selection of burning conditions--and they offer general rules for lowering the cost.

---------- and Moore, E. B.
1949. THE ECOLOGICAL ROLE OF PRESCRIBED BURNS IN THE PINE-OAK FORESTS OF SOUTHERN NEW JERSEY. Ecology 30: 223-233.

The ecological effect of prescribed fires is to remove much of the forest floor and favor the germination of pine, at the same time discouraging reproduction of the less-valuable oaks. The effect on minor vegetation is to reduce shrubby understories in density and height, and to replace some of this understory with herbs. These changes also lessen the amount of fuel available for wild fires.

* ---------- and Somes, H. A.
1949. SLASH DISPOSAL IN OAK-PINE STANDS OF SOUTHERN NEW JERSEY. Northeast. Forest Expt. Sta. Paper 31. 12 pp. Upper Darby.

Discussion of the fire hazard created by slash and the role of prescribed burning, as a silvicultural treatment, in reducing this hazard. Effect of slash on reproduction is discussed. Relative merits of different methods of slash disposal on different kinds of stands are considered. The authors believe the cheapest and most effective way to deal with slash in these stands is the periodic use of prescribed burns before harvest cuttings.

Mollenhauer, Wm., Jr.
1938. TOOLS AND METHODS IN AN EXPERIMENTAL PRUNING OF WHITE PINE. Jour. Forestry 36: 588-599, illus.

Of 21 tools tested, the California 5½-point saw was found to be the best all-around tool. The "Tarzan" method of

pruning was superior to the ladder method. Stand density had little effect on pruning time.

* Ostrom, C. E.
1937. TREE FORM AND DEFECTS IN YOUNG BEECH-BIRCH-MAPLE-HEMLOCK STANDS. Allegheny Forest Expt. Sta. Tech. Note 14. 2 pp. Philadelphia.

Records are summarized to give an idea of tree conditions to be found in stand-improvement work in young growth in the beech-birch-maple-hemlock type.

* ----------
1941. ELIMINATING HARDWOOD STUMP SPROUTS. Allegheny Forest Expt. Sta. Tech. Note 32. 1 p. Philadelphia.

Stump sprouts are a nuisance on cleared right of ways. The most effective and cheapest method of control is to break them off the stump in early summer for 2 or more consecutive years.

* ---------- and Hough, A. F.
1944. EARLY WEEDING IN NORTHERN HARDWOODS. Jour. Forestry 42: 138-140, illus.

In Elk County, Pennsylvania, plots of 13- and 18-year-old second- and third-growth sprout clumps and weed species were weeded. Three intensities of cutting were used. Results indicate an increase of 46 to 77 percent in diameter growth, with a corresponding increase in height growth. For best results the crop trees should be released from top and sides.

Simmons, E. M.
1935. PRUNING AND THINNING A WHITE PINE PLANTATION IN THE SOUTHERN APPALACHIANS. Jour. Forestry 33: 519-522.

Crew organization, marking methods, and use of tools are described for a combined pruning and thinning operation on the Nantahala National Forest.

Sleeth, Bailey, and Bidwell, Bradford.
1936. RECOMMENDATIONS FOR KEEPING THE DECAY HAZARD AT A MINIMUM IN SILVICULTURAL CUTTINGS IN CONNECTICUT SPROUT HARDWOOD STANDS. Conn. Forestry Dept. Progress Rpt. Cir. 3. 4 pp.

Because of large areas of sprout reproduction, it is necessary to keep decay loss to a minimum. The authors classify types of sprout crotches, and offer general recommendations on what kinds of sprouts to favor and what kinds to cut.

Snow, Albert G., Jr.
1938. PROGRESS REPORT ON A SET OF SPRUCE THINNING PLOTS ESTABLISHED IN 1906 IN CORBIN PARK, N. H. Jour. Forestry 36: 19-25, illus.

A moderate thinning in well-stocked old-field spruce stands was found to be successful in increasing yields and bringing about the establishment of coniferous reproduction. It also caused a reduction in normal mortality from 620 trees per acre, which died on the control plots, to 150 trees per acre on the thinned plots over a 29-year period. In dense stands these thinnings can be made to pay for themselves.

* Westveld, M.
1929. GIRDLING HARDWOODS TO RELEASE SPRUCE AND FIR. Northeast. Forest Expt. Sta. Tech. Note 1. 1 p. Amherst.

Hardwoods in test plots at Corbin Park, N. H., were girdled in 1905 to release the young understory of pulpwood species. At the end of a 22-year period a heavily girdled plot had a volume of 902 cubic feet; an untreated plot had only 158 cubic feet. Through girdling it is believed possible to convert a young hardwood stand containing an understory of spruce into a pure coniferous stand.

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1930. GIRDLING HARDWOODS TO RELEASE SPRUCE AND BALSAM FIR. Jour. Forestry 28: 101.

Report on Corbin Park plots (see above). The author says pulpwood operators can increase their pulpwood resources more cheaply by girdling than by buying more pulpwood lands.

Westveld, M.

1930. GIRDLING UNMERCHANTABLE HARDWOODS STIMULATES GROWTH OF ASSOCIATED PULPWOOD SPECIES. U. S. Forest Serv. Forest Worker 6 (5): 9.

Report on Corbin Park plots (see above.)

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1931. RELEASING MERCHANTABLE SIZED SPRUCE AND FIR THROUGH GIRDLING. Northeast. Forest Expt. Sta. Tech. Note 8. 1 p. Amherst.

Additional data from girdling experiments indicate highest returns can be realized by girdling hardwoods that suppress pulpwood trees already of merchantable size. A girdling study in a typical mixed stand near Patten, Maine, showed that growth increased during an 11-year period after girdling (in 1919) from 1/7 cord per acre per year to 3/4 cord per acre per year, a net profit of $2.00 per year. Profit can be made by such girdling in 4 years; growth in the first 2 years will pay costs of girdling.

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1931. GIRDLING TO RELEASE MERCHANTABLE SIZED SPRUCE AND FIR. Pulpwood 4 (3): 8-10, illus.

See above.

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1932. RELEASING MERCHANTABLE-SIZED SPRUCE AND FIR THROUGH GIRDLING. Jour. Forestry 30: 94-95.

See above.

---------- and others.

1932. THE IMPROVEMENT OF COMPOSITION OF STANDS IN NEW ENGLAND. Jour. Forestry 30: 670.

A report by the committee on silviculture, New England Section, Society of American Foresters, discussing the economic aspects of stand-improvement measures as a means of improving the composition of timber stands in New England. General adoption of stand-improvement measures is necessarily dependent to a great extent on finding markets for products derived from such operations.

Westveld, Marinus.
1935. WEEDING AS A STAND IMPROVEMENT MEASURE ON CUT-OVER SPRUCE LANDS. Northeast. Forest Expt. Sta. Occas. Paper 5. 12 pp., illus. New Haven.

Cut-over spruce-fir stands can be restored if weeding is undertaken to favor softwood species. The time to weed is when overtopping trees begin to cause injury to prospective crop trees. In many stands one moderate selective weeding is sufficient to insure a high-quality stand. This method is cheaper than planting. The author discusses tools, methods, costs, and time for weeding.

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1935. WEEDING AS A STAND IMPROVEMENT MEASURE ON CUT-OVER SPRUCE LANDS. Forestry Chron. 11: 241-252, illus.

See above.

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1936. INCREASE PRODUCTION OF SPRUCE BY GIRDLING HARDWOODS. Northeast. Forest Expt. Sta. Tech. Note 23. 3 pp., illus. New Haven.

Remeasurement in 1935 of test plots at Corbin Park, N. H., substantiated earlier findings that girdling hardwoods to release spruce is effective in increasing spruce growth. In the past 10 years the heavily girdled plot grew at the rate of 98 cubic feet per acre, the ungirdled plot at less than 2 cubic feet. Two-thirds of the volume on the heavily girdled plot was of merchantable size in 1935.

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1936. INCREASE PRODUCTION OF SPRUCE BY GIRDLING HARDWOODS. Forestry Chron. 12: 125-127, illus.

See above.

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1937. INCREASING GROWTH AND YIELD OF YOUNG SPRUCE PULPWOOD STANDS BY GIRDLING HARDWOODS. U. S. Dept. Agr. Cir. 431. 19 pp., illus.

Report on 1935 remeasurement of Corbin Park plots (see above).

# HARVEST CUTTING

# AND NATURAL REGENERATION

Allegheny Forest Experiment Station.
1944. GUIDES FOR CUTTING TIMBER IN THE NORTHEAST. U. S. Dept. Agr. AWI-90. 12 pp.

Guides for cutting Allegheny hardwoods-hemlock, eastern white pine, loblolly pine of the Eastern Shore, oak forests in the Northeastern and Middle Atlantic States, New England hardwood forests, and red spruce. Each of these types is described, and information is given on estimating the stand, planning how heavy a harvest cutting to make, what not to cut, and how to treat small trees.

Ferree, Miles J.
1948. GROWTH, CULL, AND MORTALITY AS FACTORS IN MANAGING TIMBER IN THE ANTHRACITE REGION. Northeast. Forest Expt. Sta. Paper 15. 21 pp., illus.

Growth, cull, and mortality data from 11,000 sample trees are used as criteria in developing practical guides for managing 21 main species of the Anthracite Region of Pennsylvania. Besides data designed to fill the needs of the forest research worker, the author offers information to the landowner or practical forester on questions such as when average tree growth reaches its peak in various species, size at which cull exceeds 10 percent of volume, size at which trees should be cut, relative stumpage values of the various species, and how management affects growth.

Hough, A. F.
1935. CROWN COVER AND OPEN SPACE BEFORE AND AFTER PARTIAL CUTTING ON PERMANENT SAMPLE PLOTS. Allegheny Forest Expt. Sta. Tech. Note 5. 3 pp. Philadelphia.

In a 60-year-old second-growth northern hardwood forest in Warren County, Pa., a selectively cut plot had greater total crown cover and less open space--both before and after cutting--than a plot cut to a 10-inch diameter limit. Five years after cutting, all open space was covered by a dense, low canopy of young trees.

* Hough, A. F.
1937. A STUDY OF NATURAL TREE REPRODUCTION IN THE BEECH-BIRCH-MAPLE-HEMLOCK TYPE. Jour. Forestry 35: 376-378.

Building up an understory of advance reproduction in an even-aged stand is a long-term process, even with partial cutting. Thinnings or light selective cuttings before clear-cutting will aid in the establishment of advance seedling growth from which seedling sprouts (the main source of renewal of the stand) will develop after logging damage to the seedlings.

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1943. METHODS OF HARVESTING SAWTIMBER FROM FORESTS IN THE HIGH PLATEAUS SECTION OF PENNSYLVANIA. Jour. Forestry 41: 898-903, illus.

Commercial cuttings that left 7,000 board feet per acre in trees 10 inches (d.b.h.) and larger resulted in subsequent periodic annual growth of 349 board feet per acre; areas left with as little as 500 board feet had a growth rate of only 196 board feet. Excellent growth of saw timber can be obtained by a series of partial cuttings.

* ----------
1945. SILVICULTURE OF MINE-PROP CUTTING IN WESTERN MARYLAND. Jour. Forestry 43: 642-645.

From studies of harvesting methods, the author concludes that second-growth stands should be cut selectively on a 10-year cutting cycle, thus building up the growing stock of saw timber. The selection should not be to a diameter limit, but should be spread over all diameters to benefit the stand as well as to give the woodcutter a chance to harvest some of the tree sizes that pay better.

* Huberman, M. A., Taylor R. F., and Nutting, A. D.
1942. RENOVATING THE PINE LOT FOR CONTINUOUS PRODUCTION. Maine Ext. Bul. 303. 12 pp., illus.

It is better business to renovate the woodlot so that it will continue to produce an income for the owner by selective cutting. The authors use a 90-acre white pine woodlot as a sample case.

* Jensen, Victor S.
1939. HARVESTING SECOND-GROWTH WHITE PINE.
East. States Co-op. 15(8): 10-11, illus.

Two adjacent old-field white pine stands, one 45 years old and the other 65 years old, were clear-cut. Production cost was $1 per thousand board feet higher for the younger stand. Author recommends selective cutting of trees 10 inches and larger. Smaller trees should be cut only for stand improvement.

* Korstian, C. F., and Stickel, Paul W.
1927. THE NATURAL REPLACEMENT OF BLIGHT-KILLED CHESTNUT.
U. S. Dept. Agr. Misc. Cir. 100. 15 pp., illus.

Blight-killed chestnut is being replaced naturally by oaks and other desirable hardwood species in the Northeast. Accelerated growth rates in the residual stands, though less than that of the original chestnut, will satisfactorily replenish the depleted growing stock. Cutting methods designed to increase the proportion of desirable species are recommended. Replacement by planting is discouraged.

---------- and Stickel, P. W.
1927. NATURAL REPLACEMENT OF BLIGHT-KILLED CHESTNUT IN THE HARDWOOD FORESTS OF THE NORTHEAST. Jour. Agr. Res. 34: 631-648, illus.

See above.

* Kraemer, J. Hugo
1937. SUGGESTIONS FOR SILVICULTURAL MEASURES IN OLD FIELD SPRUCE-FIR STANDS IN THE NORTHEAST. Jour. Forestry 35: 948-953, illus.

Recommends a partial cutting to remove large, limby trees, reduce the proportion of fir to spruce, and thin dense stands. A group-selection cutting 10 to 20 years later, removing no more than 35 percent of the basal area, would increase growth and encourage the establishment of reproduction. In a third cut, selected spruce crop trees would be harvested for sawlogs. The long-range objective should be production of Christmas trees, pulpwood, and sawlogs.

Lyman, Robert R., and Ostrom, Carl E.
1943. KEEP THEM GROWING: SAVE TIME AND TIMBER WHILE HARVESTING CHEMICAL WOOD. Forest Leaves 33 (2-3): 3, 10-13, 16, illus.

Primarily because of the wartime labor shortage the chemical-wood industry is having difficulty obtaining a sufficient supply of wood. Through modern logging methods and a system of selective cutting this condition can be alleviated.

* McLintock, Thomas F.
1947. SILVICULTURAL PRACTICES FOR CONTROL OF SPRUCE BUDWORM. Jour. Forestry 45: 655-658.

The author recommends these silvicultural measures to control spruce budworm in the Northeast: (1) Cut the larger balsam fir; (2) remove the small fir of poor vigor; and (3) remove spruce 12 inches and larger. In general, stands managed this way are less susceptible to budworm damage.

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1949. MAPPING VULNERABILITY OF SPRUCE-FIR STANDS IN THE NORTHEAST TO SPRUCE BUDWORM ATTACK. Northeast. Forest Expt. Sta. Paper 21. 20 pp., illus. Upper Darby.

To control the spruce budworm through cutting practices, loggers should concentrate their operations on highly vulnerable stands. To do this they need some quick and accurate way to map their timber holdings according to budworm vulnerability. The author offers such a method.

Northeastern Forest Experiment Station.
1945. GUIDE FOR CUTTING LOBLOLLY PINE OF THE EASTERN SHORE. U. S. Dept. Agr. AIS-2. 8 pp., illus.

A simple cruising method for farmers is suggested. Cutting and marketing methods are described briefly. Several log rules are discussed, and volume tables for these are included.

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1945. GUIDE FOR CUTTING ALLEGHENY NORTHERN HARDWOODS. U. S. Dept. Agr. AIS-3. 9 pp., illus.

See above.

Northeastern Forest Experiment Station.
1945. GUIDE FOR CUTTING NEW ENGLAND NORTHERN HARDWOODS. U. S. Dept. Agr. AIS-4. 8 pp., illus.

See above.

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1945. GUIDE FOR CUTTING OAK FORESTS. U. S. Dept. Agr. AIS-5. 9 pp., illus.

See above.

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1945. GUIDE FOR CUTTING RED SPRUCE. U. S. Dept. Agr. AIS-6. 9 pp., illus.

See above.

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1945. GUIDE FOR CUTTING EASTERN WHITE PINE. U. S. Dept. Agr. AIS-7. 8 pp., illus.

See above.

Ostrom, C. E.
1938. CLEAR CUTTING OF YOUNG NORTHERN HARDWOODS STANDS. Jour. Forestry 36: 44-49.

In northwestern Pennsylvania close utilization has led to clear-cutting. Old-growth hardwoods were successfully regenerated by this method. But clear-cutting young second-growth stands was unsuccessful; the tolerant, valuable species failed to seed in and the area reverted to intolerant weed species and sprouts.

* Recknagel, A. B., Churchill, H. L., Heimburger C., and Westveld, M.
1933. EXPERIMENTAL CUTTING OF SPRUCE AND FIR IN THE ADIRONDACKS. Jour. Forestry 31: 680-688, illus.

Preliminary report on a series of five cutting plots established near Newcomb, N. Y., to determine the practicability of reducing the interval between successive cuts of pulpwood on the same area so that loss from decay and windfall can be reduced and practically all pulpwood growth may be utilized. (See WESTVELD, 1930, Canad. Woodlands Rev. 2 (12): 8. p. 75.)

* Recknagel, A. B., and Westveld, Marinus.
1942. RESULTS OF SECOND REMEASUREMENT OF ADIRONDACK CUTTING PLOTS. Jour. Forestry 40: 837-840.

The significant results of the second 5-year remeasurement of five cutting plots (see above). Analysis of data indicates that in stands of the character represented in the experiment no net increase in merchantable volume of spruce and fir will occur for at least 9 or 10 years after cutting.

---------- and Westveld, M.
1942. HOW CUTTING AFFECTS FOREST GROWTH.
Pulp and Paper Mag. Canada. 43: 966-968.

Account of second 5-year remeasurement of experimental cutting plots in the Adirondacks (see above).

Spaulding, Perley.
1938. A SUGGESTED METHOD OF CONVERTING SOME HEAVILY NECTRIA-CANKERED HARDWOOD STANDS OF NORTHERN NEW ENGLAND TO SOFTWOODS. Jour. Forestry 36: 72.

In northern New England there are extensive areas of hardwood pole forest heavily cankered with Nectria. To encourage the seeding of softwoods in these areas the properly spaced trees in the softwood reproduction should be released and on the areas where there is no natural softwood reproduction groups of 50 or more spruce should be planted.

* ---------- Westveld, Marinus, and Hansbrough, J. R.
1942. BALSAM FIR--USE IT, DON'T LOSE IT.
Northeast. Forest Expt. Sta. Tech. Note 49.
2 pp. New Haven.

Partial cutting of spruce-fir stands at intervals of not more than 20 years (removing balsam fir 50 to 70 years old, and spruce on a selection basis), coupled with cultural treatment to maintain a thrifty growth of properly spaced crop trees, will not only reduce the loss from rot and windfall, but will also greatly increase the average diameter that balsam fir will attain before reaching the age at which cull and windfall become critical.

* Taylor, R. F.
1946. A COMPARISON OF SILVICULTURAL MARKING AND CUTTING PRACTICE RULES IN A NORTHERN HARDWOOD STAND. Jour. Forestry 44: 41-46.

Three "cutting-practice rules" are compared with good silviculture in a 50- to 60-year-old Allegheny hardwood stand. Rule 1 provides a 14-inch diameter limit; Rule 2 provides for leaving a certain number of poles or trees per acre; Rule 3 provides for a cut of as much as 40 percent of the total board-foot volume, mostly in trees 14 inches d.b.h. or larger. In their order of desirability, the methods tested were rated as follows: (1) silvicultural marking, (2) Rule 3, (3) Rule 1, and (4) Rule 2.

* Westveld, Marinus.
1928. OBSERVATIONS ON CUTOVER PULPWOOD LANDS IN THE NORTHEAST. Jour. Forestry 26: 649-664, illus.

A preliminary report on reproduction conditions in cut-over spruce lands of the Northeast, based on examinations (over a 3-year period) of extensive areas representing a wide variety of types, site quality, composition, and age of cutting.

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1929. HOW FULL STANDS OF PULPWOOD MAY BE GROWN. Canada Lumberman 49 (20): 44-46, illus.

By adhering to a few simple practical measures such as effective fire protection, conservative logging practices, and skillful cutting methods, much can be done toward maintaining spruce lands in a productive condition. The author outlines the silvical habits of spruce, and discusses cutting methods, slash disposal, and cultural operations such as girdling and weeding.

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1929. MAINTAINING PULPWOOD SPECIES ON CUTOVER LAND. Pulpwood 2 (3): 6-8, illus.

See above.

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1929. MAINTAINING PULPWOOD SPECIES ON CUTOVER LAND. Canad. Woodlands Rev. 1 (1): 21-24, illus.

See above.

Westveld, Marinus.
1930. SLASH CONDITIONS ON CUTOVER SPRUCE-HARDWOOD LANDS IN THE NORTHEAST. Northeast. Forest Expt. Sta. Tech. Note 5. 1 p. Amherst.

Lumbering operations leave as much as 39 percent of the ground covered with slash. Dense softwood slash effectively prevents the establishment of new reproduction for a period of 15 to 20 years, while hardwood slash rarely hinders reproduction for more than 6 years.

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1930. A PULPWOOD CUTTING EXPERIMENT. Canad. Woodlands Rev. 2 (12): 8.

Announces establishment of five 30-acre sample plots for a study of different silvicultural methods of cutting for pulpwood on spruce-fir lands in the Adirondacks (in cooperation with Finch Pruyn & Company and Cornell University). The objective is short cutting-cycle operations to reduce loss from windfall and decay.

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1931. PULPWOOD CUTTING EXPERIMENT BEGUN IN THE ADIRONDACKS. Jour. Forestry 29: 135-136.

See above.

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1931. REPRODUCTION ON PULPWOOD LANDS IN THE NORTHEAST. U. S. Dept. Agr. Tech. Bul. 223. 52 pp., illus.

The author describes the spruce types in the region and discusses the reproduction conditions in each type. Describes effects of various cutting methods, soils, exposure, and seedbed conditions on composition of reproduction; effects of competing growth; relative growth rates of spruce and fir; slash disposal and its effect on reproduction. The bearing these factors have on management for pulpwood is discussed.

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1938. SILVICULTURAL TREATMENT OF SPRUCE STANDS IN NORTHEASTERN UNITED STATES. Jour. Forestry 36: 944-950.

A summing-up of fundamental facts in the silvicultural treatment of spruce stands, and a discussion of the methods of cutting, cultural operations, and slash disposal necessary

for the best regeneration and growth. Definite rules are offered; costs and benefits from certain kinds of treatments are compared.

* Westveld, Marinus, and Snow, Albert G., Jr.
1940. REPRODUCTION CONDITIONS ON CUT-OVER OLD-FIELD SPRUCE STANDS IN NEW ENGLAND. Northeast. Forest Expt. Sta. Tech. Note 32. 2 pp. New Haven.

The majority of cut-over old-field spruce areas have satisfactory reproduction of spruce and fir; however, hardwoods have increased at the expense of the conifers. The authors attribute this to the soil, which originally supported hardwoods. They believe that weeding and release cuttings are necessary for the production of spruce and fir following the cutting of old-field spruce stands.

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1945. POSSIBLE ROLE OF FOREST MANAGEMENT IN COMBATTING THE SPRUCE BUDWORM. Canad. Pulp and Paper Assoc., Woodlands Sect. Index 723 (F-3).

The author attributes the present high susceptibility of spruce-fir forests to budworm attack largely to clear-cutting practices that favor balsam fir, a highly susceptible species, over spruce. He recommends the use of selection cutting as a means of encouraging spruce regeneration, thus reducing the stands' vulnerability to attack.

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1945. BUDWORM RESISTANT CUTTING METHODS.
Canada Dept. Agr. Forest Insect Invest. 1 (3): 2. Ottawa.

A brief article outlining how Canadian pulpwood operators are cooperating with American foresters in cost studies of selective cutting methods designed to increase the resistance of spruce-fir stands to the spruce budworm.

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1946. FOREST MANAGEMENT AS A MEANS OF CONTROLLING THE SPRUCE BUDWORM. Jour. Forestry 44: 949-953.

The basis for forest-management control of budworm lies in the preference of the budworm for balsam fir. Control should be sought through two types of cutting: (1) pre-salvage cuttings to remove as many high-hazard balsam fir as possible, thus reducing the food supply and breeding conditions preferred

by the insect, and (2) selection cuttings aimed at building up the resistance of stands to budworm attack by increasing the proportion of spruce and maintaining a vigorous growing stock. The author believes these goals can be attained best through short-cycle cuttings.

## ARTIFICIAL REGENERATION

Behre, C. Edward
1932. SOME ASPECTS OF THE FOREST PLANTING SITUATION IN THE NORTHEAST. Jour. Forestry 30: 162-168.

For every 5 acres of farm land being abandoned each year in the Northeast, only 1 is being reforested. Assuming that a large portion of such idle land should be returned to forest through planting, the progress now being made is not satisfactory. More knowledge of planting principles, both in the nursery and in the field, is needed to stimulate additional planting. The author stresses the magnitude of the job to be done and discusses some of the problems to be solved.

Fenton, Richard H., and Callward, Floyd M.
1948. HOME-GROWN CHRISTMAS TREES FOR CONNECTICUT. Univ. Conn. Ext. Serv. Bul. 409. 16 pp., illus. Storrs.

Connecticut, located conveniently close to metropolitan markets, offers good opportunities for growing Christmas trees commercially. The authors tell what species are best in Connecticut, sources of planting stock, planting procedures, how to manage a plantation, and methods of harvesting and marketing.

* Hetzel, J. E.
1939. A GUIDANCE LEAFLET FOR CCC PLANTING IN NORTHWESTERN PENNSYLVANIA. Allegheny Forest Expt. Sta. 13 pp. Philadelphia.

A description of planting sites, specific treatments for local sites, and soil and site requirements of 13 softwood and hardwood species. Instructions on transportation and care of planting stock.

* Hetzel, J. E.
1940. SOME RECENT IMPROVEMENTS IN THE TRANSPORTATION AND STORAGE OF PLANTING STOCK IN THE FIELD. Allegheny Forest Expt. Sta. Occas. Paper 2. 7pp., illus. Philadelphia.

A general discussion of the transportation of planting stock from nursery to field planting site, with plans and bills of materials for a collapsible shipping crate, a hardware cloth basket for eliminating daily construction of temporary heeling-in beds, and a central or project heeling-in bed to handle large quantities of planting stock for extended periods.

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1941. FOREST PLANTATIONS IN NORTHWESTERN PENNSYLVANIA. Allegheny Forest Expt. Sta. Occas. Paper 3. 5 pp., illus. Philadelphia.

A survey, based on a study of 73 plantations on old fields and other cleared sites, showed that conifers were more successful than hardwoods. Red pine, the larches, jack and pitch pine, and Norway spruce are the most desirable species for plantations when planted on the proper sites.

* McQuilken, W. E.
1946. USE OF MULCH, FERTILIZER, AND LARGE STOCK IN PLANTING CLAY SITES. Jour. Forestry 44: 28-29.

In an experiment involving two sizes of black locust and red pine stock, fall-planted on a bare, clay site with and without mulch and mineral fertilizer, frost heaving was greatly reduced by the use of mulch, and was somewhat lessened by the use of large stock and fertilizer. Growth of the locust was markedly increased by the fertilizer, whereas the red pine was somewhat injured.

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1946. TESTS OF DIRECT SEEDING WITH PINES IN THE PIEDMONT REGION. Jour. Agr. Res. 73: 113-136.

Direct seeding tests with loblolly, shortleaf, and Virginia pines were made during 3 years on slightly and severely eroded old-field sites in the Virginia and South Carolina Piedmont. Drought was the greatest obstacle to seedling establishment; frost heaving also caused heavy losses; rodents and birds were not important factors. Direct seeding

proved to be much less dependable than planting nursery-grown stock, and therefore is recommended only as a supplemental method for artificial forest regeneration.

McQuilkin, W. E.
1949. DIRECT SEEDING OF TREES. U. S. Dept. Agr. Yearbook 1949: 136-146.

Direct seeding, which bypasses the nursery and transplanting operations, may be a simple, fast, and cheap method of reforestation. Advantages and disadvantages, principles and methods are discussed. The newest technique, dropping seed from aircraft, is described; and costs are shown. General recommendations for the use of direct seeding are offered.

* Morey, H. F.
1935. A SUCCESS INDEX FOR YOUNG FOREST PLANTATIONS. Northeast. Forest Expt. Sta. Tech. Note 16. 3 pp. New Haven.

A chart index based on data from plantations ranging from 3 to 15 years in age. Survival and height growth are the main factors. The chart may be used to determine a relative success index by comparing one plantation with another, or to compare the height growth of the plantation with the average on which the chart is based.

* Ostrom, Carl E., and Ferree, Miles J.
1942. SPECIES AND SIZES OF STOCK FOR PLANTING IN NORTHWESTERN PENNSYLVANIA. Allegheny Forest Expt. Sta. Tech. Note 37. 1 p. Philadelphia.

In planting stock of the same age, the larger seedlings consistently showed better survival and greater growth. Black locust rated high on difficult sites and white spruce grew faster under an overstory of other trees.

Reineke, L. H.
1939. PLANTABILITY RATING.
Planting Quart. 8 (2): 17-19.

A method of rating a planting site is outlined. The method is based on time required to take soil borings. Considerable detail is given on how to make borings and evaluate the findings.

* Reineke, L. H.
1942. EFFECT OF STOCKING AND SEED ON NURSERY DEVELOPMENT OF EASTERN WHITE PINE SEEDLINGS. Jour. Forestry 40: 577-578.

A significant difference is found for seedling development when density is reduced. Stems are longer, diameters increase, tap roots are longer, lateral roots increase, and more terminal buds develop. In short, reduced density of seedlings shortens the preparation time for planting stock.

Schreiner, Ernst J.
1937. SILVICULTURAL METHODS FOR REFORESTATION WITH HYBRID POPLARS. Paper Indus. and Paper World 19: 156-163, illus.

It was found that most poplars can be propagated readily by means of cuttings from 1-year-old sucker shoots. Special precautions must be taken when storing planting stock. Results from experimental plantings of hybrids in Maine indicate that: (1) It is uneconomical to establish plantations on grass land; (2) excellent stands can be established by cleaning cut-over land of slash and weed trees and planting the spring after logging; (3) 20-inch cuttings can be used on moist sites but on drier sites rooted stock should be used; (4) careful bedding of stock is essential; and (5) silvicultural methods to control diseases are necessary.

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1940. INHIBITING EFFECT OF SOD ON THE GROWTH OF HYBRID POPLAR. Northeast. Forest Expt. Sta. Occas. Paper 8. 11 pp., illus. New Haven.

Dormant cuttings of hybrid poplar were planted in sod; in circular scalps 6, 12, and 24 inches in diameter; and in plowed ground. Survival for all methods of site preparation was high, but average height growth on sod was only 10 inches as compared to 45 inches on plowed ground. Hybrid poplar cannot be successfully established on grass land without adequate site preparation.

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1945. HOW SOD AFFECTS ESTABLISHMENT OF HYBRID POPLAR PLANTATIONS. Jour. Forestry 43: 412-427, illus.

A planting experiment was laid out on land that had been in undisturbed sod for at least 25 years. Several methods of site preparation were tested. The hybrids responded

best where the sod was turned under and the sod-free area was weeded during the first growing season. The author suggests site preparation and after-care to overcome difficulties in planting other hardwoods.

* Schreiner, Ernst J.
1945. VARIATION BETWEEN TWO HYBRID POPLARS IN SUSCEPTIBILITY TO THE INHIBITING EFFECT OF GRASS AND WEEDS. Jour. Forestry 43: 669-672, illus.

The susceptibility of poplars to the effect of sod makes it difficult to find types that can be planted without site preparation. Breeding of volunteer hardwood species on old fields may, however, result in varieties that can be planted successfully without previous site preparation.

Shirley, Hardy L.
1940. THE TASK FOR A CENTRAL FOREST SEED LABORATORY. Forest Leaves 39 (2): 3, 11.

Because of the need for forest tree seed for planting abandoned farm land and fire-scarred and cut-over areas, the author proposes a central forest seed laboratory. It would select and test the best varieties, and determine methods of treatment to get quick germination.

Stewart, Guy R.
1935. CRITERIA OF FERTILITY LEVELS AS A GUIDE TO PLANTING OLD FIELDS. Northeast. Forest Expt. Sta. Tech. Note 17. 2 pp. New Haven.

The relation of open land ground cover to tree-growing possibilities. Grass and herbacious species are good indices of site for forest types.

* Stickel, Paul W.
1930. ARTIFICIAL vs. NATURAL REPLACEMENT ON BLIGHT-KILLED CHESTNUT LAND. Northeast. Forest Expt. Sta. Tech. Note 3. 2 pp. Amherst.

Studies of sample plots on typical land where chestnut was blight-killed indicate that artificial replacement of the chestnut with northern white pine has been successful within 10 years. On plots where replacement has been natural, less than 50 percent of the stand has commercial value. Weeding aids materially in the growth of planted stock.

Stickel, Paul W.
1930. ARTIFICIAL vs. NATURAL REPLACEMENT ON BLIGHT-KILLED CHESTNUT LAND. Jour. Forestry 28: 572-573.

See above.

Westveld, Marinus.
1949. AIRPLANE SEEDING: A NEW VENTURE IN REFORESTATION. Soc. Amer. Foresters Proc. 1948: 302-311, illus.

Description of the methods and equipment used in reseeding--by means of an airplane--part of the Massabesic Experimental Forest (Alfred, Maine) that was burned over in the forest fires of October 1947. Mixing the seed with sawdust diluent, the flight pattern worked out, and various intensities of seeding tried are discussed. Ground checks showed satisfactory distribution. Cost was $2.94 per acre, of which $2.40 was for seed.

* ----------
1949. AIRPLANE SEEDING: A NEW VENTURE IN REFORESTATION. Unasylva 3: 95-99, illus.

See above.

Wood, O. M.
1936. EARLY SURVIVAL OF SOME PINE INTERPLANTINGS IN SOUTHERN NEW JERSEY. Jour. Forestry 34: 873-878, illus.

The history of 10,054 pine seedlings, interplanted during 1930-33 on cut-over land, was followed through 1934. By that time a mortality of 40 percent had occurred. Principal causes of this were drought, competition, animal damage, poor stock, and injury by insects.

## DEVICES

Berg, Birger.
1929. AN IMPROVED METHOD FOR NUMBERING TREES ON PERMANENT SAMPLE PLOTS. Jour. Forestry 27: 750-751.

In all intensive studies where trees are to be remeasured, some method of identifying each tree must be used. The author shows disadvantages in the use of metal tags, and

explains the rubber-stamp method used by the forest experiment stations in Scandinavia.

* Bratton, Allen W., and Ferguson, R. H.
1945. USE OF THE SPRAY GUN IN MARKING TIMBER.
Jour. Forestry 43: 113-117, illus.

Foresters are constantly seeking improved methods of marking timber. The authors discuss the use for this purpose of the spray gun, with special reference to its advantages and disadvantages and to its operation and maintenance.

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1946. ANOTHER SPRAY GUN.
Jour. Forestry 44: 206.

Where there is limited use, the Eagle spray gun can be recommended solely on the basis of the low initial cost and ease of maintenance. Comparison is made with the Alemite spray gun.

Folsom, John B.
1937. A PRACTICAL TREE-MARKING INSTRUMENT.
Jour. Forestry 35: 305-307, illus.

Description of a spray gun devised for marking trees with paint, by altering an Alemite spring spray gun. Methods of use are described, and costs are compared with other methods.

Hough, A. F.
1945. A QUICK METHOD FOR TEMPORARY TREE NUMBERING.
Jour. Forestry 43: 142-143.

An ordinary hand stapling machine can be used for tacking small slips of paper onto trees (on sample plots, or as a mark for cutting). The small wire staples hold the paper on for at least a month, and they do not damage the tree as tacks or nails do.

McLintock, Thomas F.
1948. COST OF TIMBER MARKING IN PULPWOOD STANDS.
Jour. Forestry 46: 763-764.

Cutting-practice refinements call for marking trees for cutting. To determine whether costs of marking are within reason, a number of experimental cuttings were made during a 3-year period. On the basis of $10 wage per day, the cost of

marking pulpwood for cutting was 20 cents per cord, plus about 2 cents for paint. A five-man crew was found to be the best.

Morey, H. F.
1931. TAGS AND PAINTED NUMBERS ON TREES IN PERMANENT SAMPLE PLOTS. Jour. Forestry 29: 821-822.

It has been observed on loblolly pine permanent sample plots in Maryland that aluminum tags attached with copper nails were corroded at the point of contact with the nail. Aluminum tags attached with galvanized nails were still in good condition.

---------- and Stickel, Paul W.
1935. NUMBERING TREES ON PERMANENT SAMPLE PLOTS WITH RUBBER STAMPS AND PAINT. Jour. Forestry 33: 422-425.

The two most common methods used to identify individual trees on permanent sample plots are (1) numbering the small metallic tags, and (2) painting numbers on the bole. The authors discuss relative merits of both systems.

Reineke, L. H.
1940. PERMANENT SAMPLE PLOT PHOTOGRAPHY. Jour. Forestry 38: 813-815.

The problem is: how to obtain a series of photos of the same plot at different times. The author suggests methods.

* Rulison, D. E.
1942. SPECIFICATIONS AND INSTRUCTIONS FOR USE OF THE SPRAY GUN FOR MARKING TIMBER. Northeast. Forest Expt. Sta. Tech. Note 48. 2 pp. New Haven.

Experience from 5 years' use of the spray gun for marking timber is summarized. A paint mixture of one-half red oxide barn paint and one-half kerosene, thoroughly mixed and strained, worked best. Importance of daily cleaning of gun when in use and other uses for the spray gun are discussed.

Rutherford, William, Jr.
1948. FLASHLIGHT TARGET IMPROVES ABNEY SURVEYS. Jour. Forestry 46: 299.

The beam of the ordinary two-cell flashlight is visible through a brush screen that would obscure the outline of a man. By using such a flashlight as a target for running survey lines through forest with an Abney level, short shots and much brushing can be avoided.

# FOREST PROTECTION

## GENERAL

Forbes, R. D.
1933. HOW TO STOP FOREST DEVASTATION.
In A National Plan For American Forestry. 73d Cong. 1st sess., Sen. Doc. 12: 1429-1454. (Copeland Report.)

A discussion of logging practices, slash disposal, protection of forests from grazing, fire, insects, etc., as a means of preventing devastation of private forest lands in the United States. Specific practices and measures are recommended for the different major forest types.

Hough, A. F.
1934. NATURAL ENEMIES OF THE FOREST.
Forest Leaves 24 (1): 3-6, illus.

The author first discusses the relationship between animal life and plant life, then describes the three natural enemies of the forest, namely: climatic agencies, biotic or living organisms, and fire.

* McQuilkin, W. E., and Showalter, J. W.
1945. LANOLIN MIXTURES AS DRESSINGS FOR TREE WOUNDS.
Arborists News 10 (3): 17-19.

Lanolin helps heal tree wounds. When used with other materials the mixture disinfects the area treated, prevents entrance of wood-rotting fungi, prevents checking of wood, stimulates callus formation, and is toxic to parasitic organisms. Lanolin and rosin in proportions at 10 to 4 by weight is a simple combination. Other combinations are suggested for a stiffer product.

Marshall, Rush P.

1931. THE RELATION OF SEASON OF WOUNDING AND SHELLACKING TO CALLUS FORMATION IN TREE WOUNDS. U. S. Dept. Agr. Tech. Bul. 246. 28 pp., illus.

Artificial wounds on Acer rubrum, Liriodendron tulipifera, Quercus alba, Q. borealis maxima, Q. montana, and Q. velutina were coated with orange shellac. Studies through two growing seasons showed that wounds made between February 15 and May 15 developed callus growth of more desirable shape and greater area than did wounds made at any other time. Application of the shellac immediately after wounding promoted callus formation except on Liriodendron tulipifera, on which it had no appreciable effect.

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1942. CARE OF DAMAGED SHADE TREES. U. S. Dept. Agr. Farmers' Bul. 1896. 34 pp., illus.

A description of various kinds of wounds caused to shade trees by weather, man, animals, insects, and plants, and how they should be treated to minimize the damage to the tree. Tools, materials, and methods used in pruning, trimming, and dressing wounds are discussed. Treatments for special cases are outlined.

Spaulding, Perley.

1926 THE ROLE OF FUNGI IN THE DISPOSAL OF SLASH. N. Y. State Col. Forestry Forest Protect. Conf. Papers 1926: 11-13. Syracuse.

Three agents help to destroy slash: fire, insects, and fungi. Fire does a quick, cheap, sanitary job. Insects work hard, boring holes and so on, but they do not stay to finish the disposal job. Fungi work slowly, but they keep at it till the job is done. Many kinds of fungi attack slash; in general, they are not fungi that damage living trees.

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1929. RELATION OF PATHOLOGY TO FORESTRY IN THE NORTHEAST. Canad. Woodlands Rev. 1 (3): 7-8, 18, illus.

Losses due to decay of wood and standing trees by fungi, diseases of tree seedlings, and disposal of slash by decay are examples of pathological problems affecting all producers and users of forest crops. The greater virulence of

introduced tree diseases, as compared to the native fungi, is emphasized. The Northeast is especially concerned with new diseases that may be introduced on exotic trees and shrubs.

Spaulding, Perley.
1929. DECAY OF SLASH OF NORTHERN WHITE PINE IN SOUTHERN NEW ENGLAND. U. S. Dept. Agr. Tech. Bul. 132. 20 pp., illus.

Fruiting bodies of wood-rotting fungi begin to form on white pine slash in the second year after logging. Slash becomes a fibrous mold on the forest floor by the twentieth year. Of the 23 fungi found, Lenzites sepiaria rots most slash. Slash should be left as little as possible in direct contact with wet soil, piled compactly on dry soil, and left as felled on medium soils.

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1929. THE DECAY OF HARDWOOD SLASH IN NORTHERN NEW ENGLAND. Jour. Forestry 27: 241-245.

Rate of decay seems to be influenced mostly by species, temperature, and moisture conditions. Temperatures of 30° C. to 40° C., and median moisture conditions seem most favorable for decay. The relative rates of decay for the species studied are as follows (from fastest to slowest): aspen, poplar, paper birch, basswood, beech, maple, yellow birch, ash, oak, chestnut. Lopping the slash of ash, chestnut, and red oak will hasten decay, but lopping is of doubtful value for other species.

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1930. FACTORS INFLUENCING DECAY OF HARDWOOD SLASH IN NORTHERN NEW ENGLAND AND THEIR RELATION TO THE PRACTICE OF LOPPING. Northeast. Forest Expt. Sta. Tech. Note 4. 1 p. Amherst.

The primary factors influencing decay are species, growth rate, aspect of the slope, and soil moisture. Aspen, poplar, and paper birch decay rapidly and should not be lopped. Oak, ash, and chestnut decay more rapidly if the slash is lopped, but lopping is of doubtful value to other hardwoods.

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1930. FACTORS INFLUENCING DECAY OF HARDWOOD SLASH IN NORTHERN NEW ENGLAND AND THEIR RELATION TO LOPPING. Jour. Forestry 28: 567.

See above.

Spaulding, Perley, and Hansbrough, J. R.
1944. DECAY OF LOGGING SLASH IN THE NORTHEAST. U. S. Dept. Agr. Tech. Bul. 876. 22 pp., illus.

Logging slash creates a dangerous fire hazard in forests; it increases likelihood of fires, makes them harder to stop, and increases damage from fires. This bulletin is based on studies of methods of hastening decay of slash. It deals with the fungi most important in causing decay, the conditions that favor their activity, and the forest-management practices by which these favorable conditions can be provided.

## WEATHER INJURY

Belyea, H. C., and MacAloney, H. J.
1926. WEATHER INJURY TO TERMINAL BUDS OF SCOTCH PINE AND OTHER CONIFERS. Jour. Forestry 24: 685-690.

Injury of the cellular structure of live bud tissue by freezing has occurred in several coniferous species planted in New York. The outward appearance of this damage is similar to that caused by warm spring temperatures followed by a sudden drop to freezing or below and then a return to high temperatures.

Downs, Albert A.
1937. GLAZE STORM OF MARCH 17-19, 1936, IN PENNSYLVANIA AND NEW YORK. U. S. Monthly Weather Rev. 65 (3): 100-101, illus.

The storm covered 6,000,000 acres in New York and northern Pennsylvania. On the Kane Experimental Forest at elevations over 1,900 feet one-third of the cubic wood volume of second-growth forest was damaged. Climatological chart shows greatest damage at temperatures of 29° to 32° F.

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1938. GLAZE DAMAGE IN THE BIRCH-BEECH-MAPLE-HEMLOCK TYPE OF PENNSYLVANIA AND NEW YORK. Jour. Forestry 36: 63-70, illus.

The glaze storm of March 17-19, 1936, damaged 6 million acres in Pennsylvania and New York. Immediate losses were considerable because of the impossibility of salvaging all material before decay. Future losses will be from decreased volume growth and decreased quality due to deformity

and disease and insects. Black cherry suffered the greatest injury and conifers the least.

* Hough, A. F.
1936. THE DYING OF HEMLOCK AND OTHER SPECIES ON THE ALLEGHENY NATIONAL FOREST. Allegheny Forest Expt. Sta. Tech. Note 9. 2 pp. Philadelphia.

A dry period during the growing season of 1930 followed by a similar drought in the spring of 1934 resulted in the death of many hemlock and beech. This condition was further aggravated by the severe winter of 1933-34. Mortality was found to be greatest in mature, slow-growing trees of reduced vigor on ridge tops.

Huberman, M. A.
1943. SUNSCALD OF EASTERN WHITE PINE, PINUS STROBUS L. Ecology 24: 456-471, illus.

Sunscald seriously injures the cambium on the southwest side of exposed tree trunks, thus lowering tree value and reducing tree vigor. Sunscald was found on white pine averaging 4 to 10 inches in diameter, 31 to 51 years old, of intermediate crown class, and with bark thickness of 3.7 to 7.5 mm. Sunscald appears to be a winter injury, rapid freezing the probable cause. It can be avoided by use of small openings, screen trees, and pruning in more than one step.

Jackson, L. W. R.
1938. WINTER INJURY OF BUXUS SEMPERVIRENS. Phytopathology 28: 372-374.

A sudden and severe freeze caused irregular longitudinal cracks on twigs and stems of large tree boxwoods on an estate in the District of Columbia. Microscopic examination showed that separation of the bark was caused by mechanical rupture extending tangentially through the phloem and cambium. It is questionable if the freeze would have produced such injury if the trees had hardened under normal weather conditions.

* Jensen, Victor S.
1941. HURRICANE DAMAGE ON THE BARTLETT EXPERIMENTAL FOREST. Northeast. Forest Expt. Sta. Tech. Note 42. 2 pp. New Haven.

A reexamination of the Bartlett Forest's gridiron of permanent cruise plots after the hurricane of 1938 showed

that topographic features, amount of moisture in the soil, amount of foliage, size of trees, past cutting practices, density of understory, species, and stand age (even-aged or uneven-aged) all affect damage in typical White Mountain hardwood stands.

* Mesavage, Clement
1939. FROST DAMAGE TO FORESTS IN NORTHERN NEW JERSEY. Jour. Forestry 37: 345-346.

Observations of widespread frost injury to forest vegetation in northern New Jersey indicate that late spring frosts may influence the composition of forest stands. Leaves of the oaks, white ash, black locust, sycamore, yellowpoplar, and hickory were completely killed. The lateness of the season (May 13-14, 1938) was apparently a major factor in the damage.

Morey, H. F.
1935. THE EFFECT OF ABNORMAL WEATHER CONDITIONS DURING 1934 ON VEGETATION IN THE NORTHEAST. Northeast. Forest Expt. Sta. Occas. Paper 4. 6 pp. New Haven.

A report on damage to tree and shrub vegetation by the subnormally cold winter of 1933-34. Winter damage to ornamental shrubs and fruit trees amounted to thousands of dollars in some areas, and forest stands were severely damaged by winter-killing and frost cracking.

* Ostrom, Carl E.
1942. FROST AND RABBITS AS WELL AS DEER DESTROY TREE SEEDLINGS. Allegheny Forest Expt. Sta. Tech. Note 33. 2 pp. Philadelphia.

Large areas of poorly stocked land in western Pennsylvania are believed to be held in this condition by overbrowsing by deer. It was found in this study that frost and rabbits play a significant part in destroying tree seedlings.

* Sleeth, Bailey.
1938. DECAY IN BLACK CHERRY DAMAGED BY GLAZE. Allegheny Forest Expt. Sta. Tech. Note 20. 1 p. Philadelphia.

A severe sleet storm in March 1936 on the Kane Experimental Forest, Kane, Pa., broke branches and tops of black

cherry trees. In October 1937, of 25 specimens taken, 23 had wood-rotting fungi. Visible decay had progressed below the break 15 inches or more in 52 percent of the injuries.

* Spaulding, Perley, and Hansbrough, J. R.
1935. THE DYING OF BEECH IN 1934.
Northeast. Forest Expt. Sta. Tech. Note 20. 2 pp.
New Haven.

An extensive sudden dying of beech was noted in July 1934 in the vicinity of Tupper Lake, New York. No fungous fruits were found on dead or dying beech. A local drought during the 1933 growing season and winter injury during the severe winter of 1933-34 indicate that drought was the significant cause of injury, aggravated by extreme winter conditions.

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1946. SUSCEPTIBILITY OF BEECH TO DROUGHT AND ADVERSE WINTER CONDITIONS. Jour. Forestry 44: 377.

Observations indicate that injury caused by a combination of severe summer drought and unusually cold winter weather alternating with long thaws and high temperatures is not unusual. The author cites one example of such conditions at Randolph, Vt., in 1943, and another near Staceyville, Maine.

* ---------- and Bratton, Allen W.
1946. DECAY FOLLOWING GLAZE STORM DAMAGE IN WOODLANDS OF CENTRAL NEW YORK. Jour. Forestry 44: 515-519, illus.

Following a severe ice storm, which badly damaged northern hardwood stands in New York State, considerable sap rot became evident 2½ years later in many of the damaged trees, particularly hard maple. Such decay undoubtedly resulted from sunscald caused by the sudden opening of the stands. The authors recommend treatments for such damaged stands.

Stickel, Paul W.
1933. DROUGHT INJURY IN HEMLOCK-HARDWOOD STANDS IN CONNECTICUT. Jour. Forestry 31: 573-577.

Drought resulted in the death of many hemlocks, elimination of much vegetative ground cover and reproduction, and a progressive reduction in diameter growth in the hemlock-

hardwood forests of Connecticut. On poorer sites, the damage was much more severe in dense stands. Frequent thinnings to maintain open stands on poorer sites are recommended to keep drought damage to the minimum.

## FIRE

Allegheny Forest Experiment Station.
1940. INTENSIFIED PROTECTION OF WYOMING VALLEY FORESTS AGAINST FIRE THROUGH USE OF COMMUNITY LABOR. Allegheny Forest Expt. Sta. Anthracite Survey Paper 2. 12 pp., illus. Philadelphia.

A plan for an intensified program of fire protection is described. Local action is stressed. A list of physical improvements needed and the number of man-days required to accomplish them is estimated.

Dana, Samuel T.
1926. FOREST FIRES AND RECREATION. Amer. Forests 32: 515-520, 551.

The author describes the influence that campers have on fires and that forest fires have on campers. Methods of forest fire prevention and their relation to visitors to the woods are discussed.

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1926. FOREST FIRES IN CONNECTICUT, 1921-1925. Conn. State Park and Forest Comn. Rpt. 1926: 83-91.

An analysis of the data on forest fires in Connecticut for the period 1921-1925. Some of the factors considered are: place and time of occurrence, causes, class of person responsible, character of areas burned, size of fires, property destroyed, and suppression costs.

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1928. FOREST FIRES IN NEW HAMPSHIRE, 1921-1925. N. H. Dept. Forestry Bien. Rpt. 47 pp., illus.

A study of the fire records of the State for 1921-25. Results showed that 78 percent of the fires were in the southern half of the State, which was only 46 percent forested but had 79 percent of the population. Smoking was responsible for about half of the fires.

Dana, Samuel T.
1930. FOREST FIRES IN MAINE, 1916-1925.
Maine Forest Serv. Bul. 6. 73 pp., illus.

An analysis of forest fire reports for the 10-year period. Data are presented for such subjects as number of fires, area burned, size of fires, season of occurrence, cause of fires, value of timber destroyed, and cost of suppression.

* Little, S.
1945. INFLUENCE OF FUEL TYPES ON FIRE DANGER.
Jour. Forestry 43: 744-749.

The factors that collectively determine forest fire danger are discussed in relation to different types of plant cover. Danger sometimes may differ as much as two classes between two forest types in the same vicinity. Suggestions are offered for improving the evaluation of fire danger without the expense of operating separate stations in each cover type.

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1946. THE EFFECTS OF FOREST FIRES ON THE STAND HISTORY OF NEW JERSEY'S PINE REGION. Northeast. Forest Expt. Sta. Forest Management Paper 2. 43 pp., illus. Philadelphia.

Summarizes the deterioration of forest composition of New Jersey's pine region as influenced by repeated forest fires. The early fires of low intensity permitted development of stands of good quality. The severe fires that followed extensive cutting resulted in scattered and deformed pines with a dense understory of oak sprouts.

* Moore, E. B., Waldron, A. F., Seidel, W. J., and Little, S.
1941. APPRAISING FOREST FIRE DAMAGE IN NEW JERSEY.
Allegheny Forest Expt. Sta. Occas. Paper 4. 8 pp. Philadelphia.

A method is described for appraising fire damage to standing timber. The system is based on a rough plot cruise. Tables of numbers of plots tallied in each type, value of trees by d.b.h. classes, and values per acre of reproduction and grass stands are included.

* New Jersey Department of Conservation and Development and Allegheny Forest Experiment Station.
1942. FOREST FUEL TYPES OF NEW JERSEY.
N. J. Dept. Conserv. and Devel. and Allegheny Forest Expt. Sta. 30 pp., illus. Philadelphia.

This booklet describes the eight main forest fuel types: salt marsh, grass, white-cedar, pine, pine-scrub oak, oak-pine, hardwood, and hardwood-hemlock. These are subdivided, where necessary, according to occurrence on upland or lowland sites, and in even-aged or uneven-aged stands. Twenty-seven examples are illustrated.

Northeastern Forest Experiment Station.
1948. REPORT ON THE SURVEY OF TIMBER DAMAGE BY FOREST FIRES IN SOUTHWESTERN MAINE, OCTOBER 1947. Northeast. Forest Expt. Sta. 9 pp., illus. Philadelphia.

Report on a special survey made immediately after the October 1947 forest fires in southwestern Maine to determine the extent of the damage and the condition of the salvageable material. Summarizes findings on area burned, volume, species, and timber size of damaged timber.

* Nutting, A. D., and McGuire, John R.
1948. OBSERVATIONS ON FIRE-DAMAGED WHITE PINE IN SOUTHWESTERN MAINE, JULY 1948. Northeast. Forest Expt. Sta. Paper 19. 9 pp., illus. Upper Darby.

An appraisal of damage 9 months after the forest fires of October 1947. Expected signs of additional tree mortality were not conspicuous: green crowns were still green, growth of new shoots was apparently normal, and insect attacks had not yet become serious. The conditions influencing this damage are analyzed.
(See above. See also BANKS and RETTIE, 1949, Northeast. Forest Expt. Sta. Paper 30, p. ; and NUTTING, RETTIE, and BANKS, 1949, Northeast. Forest Expt. Sta. Paper 23, p. 178 .)

Ostrom, C. E.
1938. SERVANT FIRES.
Amer. Forests 44: 118-119, illus.

New Jersey has perhaps the most dangerous forest fire hazard in the northeastern United States. The great network of highways connecting large cities to seashore resorts runs through miles of pine lands. The use of fire to burn out safety strips 100 feet wide along the highways has been found beneficial in the fire-prevention program.

Reineke, L. H.
1935. A MOVABLE, CONSTANT-ORIENTATION LOOKOUT MAPBOARD. Jour. Forestry 33: 133-136, illus.

In locating fires by means of alidade and map, structural parts of the lookout cabin may block the line of sight. The author describes an arrangement that allows the mapboard to be shifted, at the same time keeping it properly oriented.

Schnur, G. Luther
1939. HEAT DRYING TO TREES OFTEN SLOW TO APPEAR. Forest Leaves 29 (1): 11, illus.

Studies of heat injury to oak trees along a firebreak in southern New Jersey where brush was burned indicate (1) that brush fires, even though small, should be at least 10 feet from any tree, and (2) that heat injury may not be apparent for 2 or more years after exposure to heat.

* Shepard, H. B.
1936. FIRE DAMAGE IN THE NORTHERN FOREST REGION. Northeast. Forest Expt. Sta. Tech. Note 24. 2 pp. New Haven.

A damage appraisal on 14 burned areas (70,379 acres) in northern Maine and Vermont following the 1935 fire season. Mortality of merchantable timber was 78 to 91 percent. The damage to reproduction and saplings was even more disastrous: 93 to 98 percent killed.

* Spaulding, Perley, Hansbrough, J. R., and Westveld, Marinus.
1939. FIRE DANGER ON RED SPRUCE SLASHINGS IN NORTHERN NEW HAMPSHIRE AS INFLUENCED BY AGE AND CONDITION OF SLASH. Northeast. Forest Expt. Sta. Tech. Note 28. 4 pp., illus. New Haven.

Relation of fire danger to age of slash is graphically presented, and the estimated amount of slash on areas 1 to 30 years after cutting is shown. The study indicates the desirability of slash reduction at the time of logging.

Stickel, Paul W.
1926. IMPORTANCE OF METEOROLOGICAL STUDIES IN FOREST FIRE PREVENTION. Forest Protect. Conf. Proc. 1926: 58-68, illus. Syracuse.

The author emphasizes the importance of meteorological studies as a basis for fire prevention. Duff moisture

content and relative humidity are important factors in fire weather determination.

Stickel, Paul W.
1927. FOREST FIRE-WEATHER RESEARCH.
Jour. Forestry 25: 604-605.

Because of the diverse forest types in the Northeast, forest fire danger in each region and type must be considered individually. Meteorologic effects must be considered as well as duff and soil characteristics.

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1928. COMPARATIVE FOREST FIRE HAZARD IN THE NORTHEAST.
Jour. Forestry 26: 456-463.

A comparison of the fire hazard in forested areas and in clear-cuttings in four of the major forest types of the Northeast. The two prime requisites for forecasting region-wide fire weather are a knowledge of (1) current moisture conditions and relative hazard of forest fuels, and (2) future trend of the weather. The author discusses the distribution of rainfall and its effect on the fire hazard, and the relation between relative humidity, duff moisture, and fire hazard.

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1928. FOREST FIRE WEATHER IN CENTRAL MASSACHUSETTS.
U. S. Monthly Weather Rev. 56: 134-136, illus.

A comparison of the spring forest-fire records for central Massachusetts during 1927 and the weather records for the same period indicates that the maximum forest-fire hazard exists between rainy periods, when the relative humidity is 40 percent or less or when the depression of the dew point is greater than 14° F.

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1929. THE CAUSES AND COST OF FOREST FIRES IN CENTRAL MASSACHUSETTS. Northeast. Forest Expt. Sta. Tech. Note 2. 2 pp. Amherst.

Analysis of fire records for central Massachusetts showed that 13,026 acres were burned over annually in 1926-28. The average number of fires annually was 814, all man-caused. The total annual damage was $101,229. The highest fire hazards were in April and May.

Stickel, Paul W.

1929. FOREST FIRES IN CENTRAL MASSACHUSETTS: THEIR CAUSES AND COST TO THE COMMONWEALTH. Jour. Forestry 27: 841-844.

See above.

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1930. SOLAR RADIATION AND FOREST FIRE HAZARD. Northeast. Forest Expt. Sta. Tech. Note 6. 2 pp. Amherst.

Solar radiation was found to dry out the duff and increase the fire hazard. Relative humidity was found valuable as an indicator of forest fire hazard because it expresses the moisture deficit of the air and gives an indication of the intensity of solar radiation. Vegetative ground cover is essential to prevent the drying-out of the duff and thus to reduce the fire hazard.

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1930. FOREST FIRE WEATHER DATA FOR THE HARDWOOD-SPRUCE FOREST TYPE. Northeast. Forest Expt. Sta. Tech. Note 7. 2 pp. New Haven.

Six degrees of fire hazard were developed, based on moisture content of the top layer of the litter. These data are offered for the hardwood-spruce forest type of the northeastern United States and eastern Canada.

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1930. FOREST FIRE WEATHER DATA FOR THE HARDWOOD-SPRUCE FOREST TYPE. U. S. Forest Serv. Forest Worker 6 (3): 20.

See above.

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1931. FOREST FIRE RESEARCH. N. Y. State Col. Forestry Empire Forester 17: 7-16, illus. Syracuse.

Forest fire weather research has a place in all aspects of fire control--prevention, presuppression, and suppression. The aims of such research are three: (1) to determine the relationship between weather conditions and forest fire hazard; (2) to determine by means of simple instruments an index to current conditions of hazard; and (3) to apply fire weather data and weather forecasts to specific problems of fire control.

Stickel, Paul W.

1931. THE MEASUREMENT AND INTERPRETATION OF FOREST FIRE-WEATHER IN THE WESTERN ADIRONDACKS. N. Y. State Col. Forestry Tech. Pub. 34. 115 pp., illus. Syracuse.

Summary of a 4-year investigation (1926-29) of forest fire weather in the western Adirondacks. Meteorological conditions are described as they relate to forest fire hazard, and the use of these conditions in estimating and forecasting fire hazard is described.

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1932. WEATHER AND FOREST FIRE HAZARD WITH SPECIAL REFERENCE TO THE SPRUCE-FIR REGION OF NORTHERN MAINE. Maine Forest Comn. 19th Bien. Rpt. 1931-32: 118-139, illus.

The author discusses the value of classifying the degree of fire hazard and the relation of weather conditions to moisture content of forest fuels.

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1932. WEATHER AND FOREST FIRE HAZARD WITH SPECIAL REFERENCE TO THE WHITE PINE REGION OF CENTRAL NEW ENGLAND. Mass. Forestry Assoc. Bul. 153. 8 pp., illus.

The causes of forest fires and the weather elements that affect forest fire hazard are described. Methods for measuring the more important weather elements involved are described and the application of these measurements to the problems of fire prevention and suppression are explained.

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1933. EXPERIMENTS WITH CALCIUM CHLORIDE AS A FOREST FIRE RETARDENT. Jour. Forestry 31: 533-542, illus.

Calcium chloride has limited value in forest fire control. It does increase moisture content of cumbustible fuels. Along railroad right of ways and fire lines, where regrowth of vegetation must be prevented, the chemical has a distinct value. But its value is practically nil on actual fires.

Stickel, P. W.

1933. THE ROLE OF SILVICULTURE IN FOREST FIRE CONTROL. Pulp and Paper Mag. Canada 34 (1): 20-24, illus.

Studies of weather and forest fire hazard in the red spruce-northern hardwood type near Cranberry Lake, N. Y., and in the white pine type at Petersham, Mass., demonstrate that the duration and intensity of forest fire hazard is much less in green timber stands than in open, exposed cut-over lands. Cutting methods designed to maintain the crown canopy are recommended for keeping forest fire hazard at the minimum.

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1934. WEATHER AND FOREST FIRE HAZARD WITH SPECIAL REFERENCE TO THE UPPER ALTITUDINAL SPRUCE-BALSAM FIR REGION OF NORTHERN NEW YORK. Jour. Forestry 32: 76-79, illus.

A combination of relative humidity, air temperature, and number of hours since last measurable precipitation can be used as an index to fuel-moisture content and inflammability. With the author's alinement chart, fuel-moisture content and inflammability can be estimated from data obtained with a sling psychrometer. Within the high altitudinal spruce-fir forest the continuous evergreen canopy gives almost complete protection against drying out of the inflammable materials on the forest floor.

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1934. FOREST FIRE DAMAGE STUDIES IN THE NORTHEAST: I. BARK BEETLES AND FIRE DAMAGED HARDWOODS. Jour. Forestry 32: 701-703.

Even lightly scorched trees suffer subsequent damage from insects and fungi. In this study more than 50 percent of the fire-scorched hardwoods showed evidence of ambrosia-beetles, whose work, even if the trees continue to live, causes a serious reduction in the quality of the most valuable part of the tree—the butt log.

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1935. FOREST FIRE DAMAGE STUDIES IN THE NORTHEAST: II. FIRST-YEAR MORTALITY IN BURNED-OVER OAK STANDS. Jour. Forestry 33: 595-598.

At least one growing season must elapse before mortality of injured trees can be ascertained, and there is probably some additional mortality the second season. Mortality is greater among small-diameter trees than among larger trees.

Stickel, Paul W., and Marco, Herbert F.
1936. FOREST FIRE DAMAGE STUDIES IN THE NORTHEAST: III. RELATION BETWEEN FIRE INJURY AND FUNGAL INFECTION. Jour. Forestry 34: 420-423, illus.

Observations on burned-over areas show that in northeastern forests between 28 and 45 percent of fire-scarred live trees become infected with fungi, causing decay of the sapwood within 3 years after burning. The rapidity with which these sapwood rots infect the trees indicates the necessity for early salvage cuttings.

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1936. "NO LOSS: THE TREES WERE ONLY SCORCHED." Wooden Nutmeg 7 (2): 1-3, illus.

Fire damage immediately after the fire is often underestimated. Loss due to basal scorching was still in progress during the third season. Three years after the fire 18 percent of the trees were disease-infected, 4 percent attacked by both insects and disease, and 1 percent infested with insects alone.

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1938. NORTHEASTERN FOREST-FIRE DANGER METERS. Northeast. Forest Expt. Sta. Tech. Note 25. 4 pp. New Haven.

A description of fire-danger classes developed for white pine, spruce-fir, and mixed northern hardwoods. Seven classes of danger, ranging from "none" to "extreme", are set up. They are based on air temperature, relative humidity, time since last rain, and wind velocity. Administrative action in preparation for fire-control work is suggested for each danger class.

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1939. SMOKERS' MATERIALS AND FOREST FIRE DANGER. Hunting and Fishing Mag. 16 (9): 12, 20, illus.

A popular article about forest fires and their causes. In the Northeast the tobacco smoker causes more fires than any other single agent.

Stickel, Paul W.

1940. NATURE OF FIRE DAMAGE TO NORTHEASTERN FORESTS. IN Important Tree Pests Of The Northeast: 173-177, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 33, 1939.)

In the Northeast, where surface fires are the general rule, damage resulting from basal scorching of trees by light burns exceeds the initial loss from outright killing. A large number of the basal-scorched trees that apparently survive the fire may be expected to die within 5 years. The general health and vigor of trees that survive after 5 years may be seriously impaired. In addition, secondary attacks of insect and fungal enemies lower the quality of the survivors materially.

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1940. AN AUTOMATIC APPARATUS FOR DETECTING AND REPORTING FOREST FIRES. Jour. Forestry 38: 502-503.

Proposes an automatic apparatus (using a photocell in conjunction with a thermocouple) for detecting forest fires; it would be rigged to signal a central station.

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1940. WHY CLOSE THE WOODS? Hunting and Fishing 17 (5): 13, 32-33, illus.

Explains briefly the principles used in measuring forest-fire danger, and points out that any action taken by forestry agencies to reduce man-caused fires by closing the woods to hunters and fishermen during dangerous periods is based not on mere guess or personal judgment, but upon sound scientific methods.

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1940. THE EFFECT OF BASAL-WOUNDING BY FIRE ON TREES IN THE NORTHEAST. Northeast. Forest Expt. Sta. Tech. Note 30. 2 pp. New Haven.

Studies were made on plots in three different forest types. Findings indicate that resultant damage from fungi and insects on trees wounded from surface fires reaches its peak 3 years later. The author recommends that forest-fire damage appraisals be made several years after the burn.

* Stickel, Paul W.
1940. SOME PRELIMINARY TABLES OF FOREST-FIRE DAMAGE VALUES FOR THE NORTHEASTERN OAK REGION. Northeast. Forest Expt. Sta. Tech. Note 31. 2 pp. New Haven.

Analysis of data from field work on fires occurring during 1934-36 indicates that average per-acre damage by fire to timber and reproduction in Connecticut and New York is considerably greater than the losses reported by fire wardens.

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1941. ON THE RELATION BETWEEN BARK CHARACTER AND RESISTANCE TO FIRE. Northeast. Forest Expt. Sta. Tech. Note 39. 2 pp. New Haven.

Certain tree species can resist fire better than others. Tests of the insulating qualities of bark showed that species that form secondary phellogen and develop layers of dead outer bark are more resistant than those that do not. Bark thickness alone does not guarantee resistance. Hemlock 9 inches in diameter was almost twice as resistant to fire as balsam fir 15 inches in diameter.

* Wood, O. M.
1936. FIRST YEAR LOSSES AFTER A FIRE MAY NOT REPRESENT TOTAL MORTALITY. Allegheny Forest Expt. Sta. Tech. Note 13. 2 pp. Philadelphia.

Mortality data are presented for four species of oak and two species of pine. Data for plots burned over in southern New Jersey 1 year previous are compared with data for 1 year and 5 years later. Total mortality was found to be considerably greater than that indicated by the data taken the first year after the fire.

## DISEASES

Boyce, J. S.
1928. A POSSIBLE ALTERNATE STAGE OF PUCCINIASTRUM MYRTILLI (SCHUM.) ARTH. Phytopathology 18: 623-625.

While in the East it has been shown that the alternate stage of Pucciniastrum myrtilli is a peridermium on eastern hemlock, there is no evidence that such a relationship exists in western hemlock. Investigation leads to the belief

that in the Pacific Northwest the aecial stage of Pucciniastrum myrtilli occurs as a peridermium on silver fir. Results are not conclusive.

Boyce, J. S.
1928. A CONSPECTUS OF NEEDLE RUSTS ON BALSAM FIRS IN NORTH AMERICA. Phytopathology 18: 705-708.

Field study shows that the age of needles on which aecia are found is of important diagnostic value, and not a single species is known in the Pacific Northwest with aecia normally on both the current season's growth and on 1-year-old needles. Presents in tabular form the alternate hosts of needle rusts of balsam fir and the age of the fir needles with aecia.

Collins, J. Franklin, and Spaulding, Perley.
1929. WILLOW DISEASE IN THE EASTERN CANADIAN PROVINCES. U. S. Dept. Agr. Plant Dis. Rptr. 13 (5): 143-144.

A report on observations of willow disease (Fusicladium saliciperdum and Physalospora miyabeana) in Nova Scotia, New Brunswick, and Quebec. Locations where specimens were collected are listed.

* Davidson, Ross W., and Campbell, W. A.
1943. DECAY IN MERCHANTABLE BLACK CHERRY ON THE ALLEGHENY NATIONAL FOREST. Phytopathology 33: 965-985, illus.

A study of cull caused by decay was made in three merchantable stands of black cherry. Twenty-two species of decay-producing fungi were isolated from 212 rot infections. The most important butt rots were caused by Polyporus spraguei, P. berkeleyi, and Coniophora cerebella. The most important trunk rots were caused by Poria prunicola, P. mutans, Fomes pinicola, and Polyporus sulphureus. These trunk rotters entered usually through large branch stubs. Most of these rots gave no external evidence of their presence except Fomes pinicola, which formed conks on half the trees it infected.

Diller, Jesse D.
1935. THE ATROPELLIS CANKER OF EASTERN PINES. U. S. Dept. Agr. Plant Dis. Rptr. 19 (2): 17.

A brief description of the disease, its known hosts, the extent of its occurrence, and the research being conducted on it.

Grant, Theodore J.
1936. NECTRIA CANKERS ON NORTHEASTERN HARDWOODS. U. S. Bur. Plant Indus., Div. Forest Path. 4 pp., illus. New Haven.

Differences in environment cause differences in canker appearance. In general, trees showing any form of abnormality should be discriminated against as crop trees. Dense young stands are recommended as a means of reducing canker formation. Observations on 3,000 cankers showed the following avenues of infection: Dead branch stubs, 56 percent; crotches of live trees, 15 percent; rubbing injuries, 8 percent. Not determined, 21 percent.

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1937. REDUCTION OF NECTRIA CANKER IN HARDWOOD FORESTS OF THE NORTHEAST. Northeast. Forest Expt. Sta. Occas. Paper 6. 4 pp. New Haven.

The present and potential value of the stand and the management objective govern the type and extent of control operations. Reduction of canker is practical only when carried out as part of regular stand-improvement work. Complete eradication is impossible.

---------- and Spaulding, Perley.
1939. AVENUES OF ENTRANCE FOR CANKER-FORMING NECTRIAS OF NEW ENGLAND HARDWOODS. Phytopathology 29: 351-358, illus.

Infection is usually through cracks in the axils of living or dying branches rather than of completely dead branches. Small young branches, buds, and short spurs (especially on birches) often serve as avenues of entry for the canker fungus. In general, small branches are more readily injured than large ones, and fall and winter injuries are more dangerous than those in spring and summer, when prompt action of the cork cambium may help check early stages of invasion.

Hahn, Glenn G.
1936. IMMUNITY OF VIKING RED CURRANT FROM WHITE PINE BLISTER RUST UNDER FIELD CONDITIONS. Phytopathology 26: 860-875, illus.

Nearly 1,000 Viking plants set out in 28 field plots exposed to white pine blister rust throughout Oregon, Northeastern United States, and Ontario, Canada, in 1932-34 showed no blister rust infection. Susceptible native Ribes set as

check plants became infected readily. Preliminary tests show that resistance is dominant in Viking seedlings from open-pollinated seed.

Hahn, Glenn G., and Ayers, Theodore T.
1936. THE EUROPEAN LARCH CANKER AND ITS RELATION TO CERTAIN OTHER CANKERS OF CONIFERS IN THE UNITED STATES. Jour. Forestry 34: 898-908, illus.

The European larch canker caused by Dasyscypha willkommii (discovered in 1927 on European larch imported from England) is confined to a small area in the vicinity of Hamilton and Ipswich, Mass. The parasite infects only species of the genus Larix and its near relative Pseudolarix. Similar and related cankers (erroneously reported to be European larch cankers) on Douglas-fir, ponderosa pine, and white pine are discussed. Symptoms and methods of controlling the true European Larch canker are outlined.

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1948. IMMUNITY OF CANADIAN BLACK CURRANT SELECTIONS FROM BLISTER RUST. Phytopathology 38: 543-456.

Two clones of black currant obtained in Canada by crossing Ribes ussuriense and R. nigrum have proved resistant to the blister rust caused by Cronartium ribicola. Plants tested both in the greenhouse and in the field appeared to be truly immune, whereas other varieties used as checks were infected.

Hansbrough, J. R.
1934. OCCURRENCE AND PARISITISM OF ALEURODISCUS AMORPHUS IN NORTH AMERICA. Jour. Forestry 32: 452-458, illus.

The fungus Aleurodiscus amorphus was found in association with cankers on lowland white fir (Abies grandis) in the Mt. Hood National Forest in Oregon. Detailed infection data are given for a 1/10-acre plot. The distribution of the fungus in North America is described and 2 new genera and 10 new species are reported as hosts.

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1935. A NEW CANKER DISEASE OF RED PINE, CAUSED BY TYMPANIS PINASTRI. Science (n.s.) 81: 408.

This disease enters the main stem at the bases of lateral branches. Cankers are produced only when the host tree

is weakened by some environmental factor. Indications are that the disease occurs only on trees in plantations. Lower crown classes are more susceptible.

Hansbrough, J. R.
1936. A NEW CANKER DISEASE OF RED PINE, CAUSED BY TYMPANIS PINASTRI. Forestry Chron. 12 (2): 142-143, illus.

A preliminary report on a disease of red pines found in the winter of 1932-33 in the Eli Whitney Forest in Connecticut. Studies indicate the disease is most prevalent in pure stands such as plantations. Its incidence seems to be related to the severe drought of 1930.

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1936. THE TYMPANIS CANKER OF RED PINE. Yale Univ. School Forestry Bul. 43. 58 pp., illus.

The canker is caused by a weak parasite of red pine, entering the stem and producing cankers only when the host tree is weakened by some environmental factor such as drought. Only trees in plantations established south of their natural range are attacked. Any practice improving the vigor of the trees will help in control. Those suggested are: mixed plantations with 8 by 8-foot spacing, pruning crop trees before branches die, and judicious thinnings.

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1940. SWEETFERN BLISTER RUST OF PITCH PINES (CRONARTIUM COMPTONIAE ARTH.). IN Important Tree Pests Of The Northeast: 129-131, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 45.)

A brief description of the fungus, its history and distribution, hosts, symptoms and damage, cause and life history, dissemination, and control.

--- and Stout, Donald C.
1947. VIRUSLIKE SYMPTOMS ACCOMPANYING BIRCH DIEBACK. U. S. Dept. Agr. Plant Dis. Rptr. 31 (9): 327.

Birch trees in dieback areas in Maine exhibited certain abnormalities associated with virus diseases. Most important were vein-clearing in the leaves of white and yellow birch trees and of sprouts from stumps of mature white birch

cut 1 to 2 years previously. Some broomlike growth was observed on white birch stump sprouts.

Hansbrough, J. R.
1947. A PATHOLOGICAL PROGRAM OF RESEARCH ON THE CAUSE OF BIRCH DIEBACK. Canad. Pulp and Paper Assoc. Woodlands Sect. Index 917 (F-3). 3 pp.

The author outlines the history of birch dieback and its apparent relation to the bronze birch borer. From studies in Maine and Canada he concludes that some unknown agent is weakening birch prior to borer attack. What is it? Poor general health of forest stands? Climate? Some undetected disease? He proposes a special research program to find the cause and a method of control.

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1948. FOREST DISEASE PROBLEMS IN THE NORTHEAST. N. Y. Forester 5 (2): 6-9.

Discussion of important disease problems that affect forest nurseries, plantations and young natural stands, and merchantable or mature stands. Important diseases, and the species they attack, are described. Though research has been concentrated on curative measures, preventative measures are being sought.

Hartley, Carl, and Jackson, L. W. R.
1933. A BROOMING DISEASE OF ROBINIA PSEUDOACACIA TRANSMITTED BY GRAFTS. (Abstract.) Phytopathology 23: 13.

The disease is common on sprouts in the Middle Atlantic States. Aside from conspicuous "witches' brooms" no definite symptom has been recognized. (This abstract contains nothing about graft transmissibility. See JACKSON and HARTLEY, 1933, Phytopathology 23: 83-90, illus. p.108.)

Jackson, L. W. R.
1933. EFFECTS OF H-ION AND ALUMINUM-ION CONCENTRATIONS ON CONIFER DAMPING-OFF. (Abstract.) Phytopathology 23: 18.

Damping-off of Douglas-fir and ponderosa pine seedlings grown in liquid and sand cultures stabilized at various acidities and inoculated with Pythium and Rhizoctonia increased from none at pH 2.5 to a maximum near the neutral point. At pH 3.5, presence of aluminum ions tended further to decrease damping-off, but not at pH 6.5.

Jackson, L. W. R.
1933. EFFECT OF SULPHURIC ACID AND ALUMINUM SULPHATE, AS USED FOR THE CONTROL OF DAMPING-OFF OF CONIFERS, ON SOIL pH. (Abstract.) Phytopathology 23: 18.

The increase in soil acidity when sulfuric acid or aluminum sulfate were applied to the surface of nursery beds for the control of damping-off was found to be limited to the upper 2 inches of soil, with the maximum change occurring in the upper $\frac{1}{2}$ inch.

---------- and Hartley, Carl.
1933. TRANSMISSIBILITY OF THE BROOMING DISEASE OF BLACK LOCUST. Phytopathology 23: 83-90, illus.

Brooming disease of black locust, presumably virus-caused, is not highly contagious. Healthy seedlings grown in physical contact with diseased trees showed no evidence of brooming after two growing seasons. The disease was successfully transmitted to healthy seedling stocks by grafting infected stem scions to them. Brooming developed as far as 3 feet from the graft within 4 to 5 months. In one instance the disease was transmitted even though the scion died.

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1935. A NEW DISEASE OF THE ORIENTAL PLANE-TREE (PLATANUS ORIENTALIS L.) PREVALENT IN THE PHILADELPHIA AREA. Natl. Shade Tree Conf. Proc. 11: 77-79.

Oriental plane trees planted along streets started to die at an alarming rate in 1933. First symptoms were longitudinal fissures in the trunks and bark lesions. Cross sections of the trunks in the region of the bark lesions showed distinct discoloration and produced pure cultures of a fungus belonging to the genus Ceratostomella--species as yet undetermined.

---------- and Sleeth, Bailey.
1935. A NEW DISEASE AFFECTING PLATANUS ORIENTALIS IN THE EASTERN UNITED STATES. (Abstract). Phytopathology 25: 22.

Isolations from the discolored wood of oriental plane trees affected by the new disease have yielded pure cultures of an endoconidiophora form of Ceratostomella. Inoculations of fourteen 2-year-old cuttings of oriental plane produced wilting after 4 to 13 weeks. Inoculations on 2-year-old seedlings of American elm and two species of oak failed to produce infections.

Jackson, L. W. R., and Crandall, B. S.
1935. A PHYTOPHTHORA ROOT AND COLLAR ROT OF PINUS RESINOSA SEEDLINGS. (Abstract.) Phytopathology 25: 22.

A disease that attacked seedling and transplant stock in one of the eastern forest nurseries is characterized by a dry type of bark rot and a vascular infection that causes the wood to become dark-colored and very resinous. The fungus has been found to be the causal organism of the root and collar rot of red pine. Inoculations with other fungi failed to reproduce the typical symptoms of root and collar rot.

* ---------- and Sleeth, Bailey.
1937. DISEASE KILLING PLANE TREES.
Forest Leaves 27 (2): 5-6, 14-15, illus.

The widespread dying of plane trees near Philadelphia in 1933 was investigated to determine if a pathogenic fungus was present. The only fungus obtained has been identified tentatively as a strain of Ceratostomella. Inoculation experiments demonstrated that the fungus was extremely parasitic on the plane tree, but not on the other hardwoods tested. Further investigation is recommended.

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1938. CYLINDROCLADIUM ASSOCIATED WITH DISEASES OF TREE SEEDLINGS. U. S. Dept. Agr. Plant Dis. Rptr. 22 (5): 84-85.

Cylindrocladium scoparium Morg. has appeared in association with diseases of tree seedlings at several forest nurseries in the eastern United States. The author lists diseases and tree species from which this fungus has been isolated and the localities where obtained.

Marshall, Rush P.
1935. THE IMPORTANCE OF GENERAL VIGOR IN COMBATING DISEASES OF SHADE TREES. Shade Tree 8 (10): 2-3. ( N. J. Fed. of Shade Tree Comns.)

Tree experts are realizing more and more that one of the best ways to reduce damage to trees by disease is to keep the trees healthy and vigorous. Some of the important factors in keeping trees healthy are water supply, temperature relations, and soil conditions.

Marshall, R. P., and Waterman, A. M.
1948. COMMON DISEASES OF IMPORTANT SHADE TREES. U. S. Dept. Agr. Farmers' Bul. 1987. 53 pp., illus.

Descriptions of the common types of parasitic diseases that affect shade trees. These include leaf diseases, wilts, cankers, wood rots, and root rots. Control methods are outlined. Diseases of 41 specific trees, and control treatments, are discussed in detail.

Miller, J. Armstrong, and Aldrich, Kenneth F.
1936. PSEUDOLARIX AMABILIS, A NEW HOST FOR DASYSCYPHA WILKOMMII. Science (n.s.) 83: 499.

A report of the first host genus other than Larix upon which the true European larch canker has been reported in America.

Roth, Elmer P., and Sleeth, Bailey.
1939. BUTT ROT IN UNBURNED SPROUT OAK STANDS. U. S. Dept. Agr. Tech. Bul. 684. 42 pp., illus.

A study of butt rot was made in the Allegheny, Appalachian, and Central States regions. Causes of rot, location and extent of rot, age of trees, presence or absence of past burning, and other related conditions were studied. Practices are suggested for keeping decay losses to a minimum.

* Sleeth, Bailey.
1938. PRUNING WOUNDS AS AN AVENUE OF ENTRANCE FOR STEREUM SANGUINOLENTUM IN NORTHERN WHITE PINE PLANTATIONS. Allegheny Forest Expt. Sta. Tech. Note 22. 3 pp. Philadelphia.

A reconnaissance was made of a number of white pine plantations in Pennsylvania in 1927 to determine the prevalence of sporophores on old pruning wounds. Results showed that, in general, the percentage of wounds bearing sporophores was greater among large wounds. Care should be taken in pruning dead branches to prevent injury to the live wood. Young pruned trees in which fungus is established are considered worthless long before they reach merchantable size.

Spaulding, Perley, and Rathbun-Gravatt, Annie.
1925. CONDITIONS ANTECEDENT TO THE INFECTION OF WHITE PINES BY CRONARTIUM RIBICOLA IN THE NORTHEASTERN UNITED STATES. Phytopathology 15: 573-583.

Many factors are necessary for the infection of white pine by Cronartium ribicola. There must be a period of sufficient moisture to germinate the teliospores, then a period of high humidity during which infection can take place.

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1925. A PARTIAL EXPLANATION OF THE RELATIVE SUSCEPTIBILITY OF THE MORE IMPORTANT AMERICAN WHITE PINES TO THE BLISTER RUST. Phytopathology 15: 591-597.

White pines vary widely in their relative susceptibility to blister rust. Indications are that persistence of leaves and distribution of stomata on the leaves both affect susceptibility. The author thinks that thickness of bark may be a factor in severity of attacks.

---------- and Rathbun-Gravatt, Annie.
1925. LONGEVITY OF THE TELIOSPORES AND ACCOMPANYING UREDOSPORES OF CRONARTIUM RIBICOLA FISCHER IN 1923. Jour. Agr. Res. 31: 901-916, illus.

During the summer of 1923 telia from eight Ribes hosts were tested for longevity. Under outdoor conditions their longevity varied from 19 days for one collection of Ribes rotundifolium to 87 days for R. nigrum.

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1925. LONGEVITY OF BLISTER RUST, TELIOSPORES AND SPORIDIA. Ann. Blister Rust Control Conf. Proc. 10: 72-73.

Telia are produced from early July until winter; few of them fail to form sporidia. Wet weather causes them to germinate, regardless of temperature. Sporidia travel long distances, but how long they survive is unknown. Alternate drying and wetting is not so deadly as supposed; some sporidia survived as many as 11 dryings. Some form secondary sporidia, which might survive long after the first set had reached the limit of viability.

Spaulding, Perley.
1925. THE WHITE PINE BLISTER RUST IN VERMONT.
Blister Rust News 9 (5): 3-4.

A brief history of the blister rust in the United States. Brought in on imported white pine stock about 1900, it was first reported in June 1909, in Vermont. Held in check by eradication of ribes around plantations, it began to escape about 1913, when the first infection of native pines was reported. In 1916 the disease broke out generally throughout New England.

---------- and Rathbun-Gravatt, Annie.
1926. THE INFLUENCE OF PHYSICAL FACTORS ON THE VIABILITY OF SPORIDIA OF CRONARTIUM RIBICOLA FISCHER.
Jour. Agr. Res. 33: 397-433.

A pioneer study of the physiology of white pine blister rust spores. The effect on viability of sporidia of such factors as drying, alternate wetting and drying, relative humidity changes, icing, sunlight, and constant wetting are described in detail. All factors except icing tended to decrease ability to germinate.

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1926. THE WHITE PINE BLISTER RUST IN GERMANY.
Jour. Forestry 24: 645-652.

Discussion of a controversy among German foresters regarding the more extensive use of 5-needled pines in German forests. Since Ribes nigrum is widely distributed in western Europe, white pine blister rust control measures are advocated before further use is made of such susceptible pines as Pinus monticola and P. strobus.

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1927. SPAULDING COMMENTS ON SUSCEPTIBILITY OF SUGAR PINE.
Blister Rust News 11 (3): 73.

Pinus lambertiana cannot be called resistant. The author has found it infected in New York State.

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1927. THE WHITE PINE BLISTER RUST IN EUROPE.
Ann. Blister Rust Control Conf. Proc. 12 (1926): 83-84.

In Europe, the blister rust is found almost exclusively on Pinus strobus and Ribes nigrum. The European climate

appears to be favorable to the disease. Blister rust has spread farther from Ribes nigrum, which is generally cultivated, than in America. No genuine attempt has been made to control the disease.

Spaulding, Perley.
1927. A SERIOUS DISEASE OF BIRCHES. (Abstract.)
Phytopathology 17: 59.

The poor condition of birches attributed commonly to the bronze birch borer was found to be associated with a fungus. Cultures were made for further work.

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1927. FORESTERS URGED TO TEST BALKAN WHITE PINE.
U. S. Forest Serv. Forest Worker 3 (6): ii.

Balkan white pine (Pinus peuce) has proved resistant to white pine blister rust in Europe. The author believes it will grow well in the United States, particularly in the colder regions.

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1927. THE EUROPEAN LARCH CANKER.
Ann. Blister Rust Control Conf. Proc. 13: 107.

This disease has been found on European larch in eastern Massachusetts. Whether it is truly the same as the foreign fungus remains to be determined.

--- and Siggers, Paul V.
1927. THE EUROPEAN LARCH CANKER IN AMERICA.
Science (n.s.) 66: 480-481.

The discovery of the European larch canker caused by the fungus Dasyscypha calycina (Schum.) Fuckel. on plantation trees in three towns in Massachusetts is reported. Hosts are European, Japanese, and eastern American larch; also possibly Douglas-fir, pitch pine, and Scotch pine. Additional host species attacked by this fungus in Europe are listed. The percentage of infection in older trees imported for plantation purposes is high. Further scouting is in progress to determine how widely this disease is distributed.

Spaulding, Perley.

1928. THE EUROPEAN LARCH CANKER.
U. S. Forest Serv. Forest Worker 4 (4): 16.

This larch canker was found in eastern Massachusetts early in 1927. A similar fungus found in native larch stands in the Northeast is described; whether the two belong to the same species is not known.

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1929. THE WHITE PINE BLISTER RUST: A COMPARISON OF EUROPEAN WITH NORTH AMERICAN CONDITIONS. U. S. Dept. Agr. Tech. Bul. 87. 58 pp., illus.

Ribes species, especially R. nigrum, are found wherever white pines are grown in Europe. R. nigrum is a favorite garden species and generally is considered of more value than the white pines; hence no effective control measures have been taken. Pinus strobus is generally infected throughout Europe. P. cembra helvetica, P. peuce, and P. excelsa are resistant to the blister rust. To grow white pines safely, the author suggests that areas be chosen where Ribes eradication will prove feasible.

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1929. WILLOW SCAB (FUSICLADIUM SALICIPERDUM).
U. S. Dept. Agr. Plant Dis. Rptr. 13 (5): 74.

Reports the presence of willow scab infections in Vermont, but not in the Connecticut Valley.

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1929. WILLOW SCAB (FUSICLADIUM SALICIPERDUM).
U. S. Dept. Agr. Plant Dis. Rptr. 13 (5): 142.

Reports collections of the fungus in northern New England, in various towns of Maine, New Hampshire, Vermont, New York, Massachusetts, and Connecticut, most of them in locations reported for the first time.

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1929. WILLOW DISEASE (PHYSALOSPORA MIYABEANA).
U. S. Dept. Agr. Plant Dis. Rptr. 13 (5): 142-143.

Reports collections in New Hampshire, New York, Massachusetts, and Connecticut. Because of its apparent limitation to twigs and sprouts, Physalospora miyabeana is not collected so commonly as Fusicladium saliciperdum, but it seems to be as widely distributed in the Northeast.

Spaulding, Perley.
1929. ADDITIONAL NOTES ON WILLOW DISEASES IN NEW ENGLAND. U. S. Dept. Agr. Plant Dis. Rptr. 13 (5): 160.

Report of specimens collected in Maine, New Hampshire, and Vermont.

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1929. THE EUROPEAN LARCH CANKER IN MASSACHUSETTS. Ann. Blister Rust Control Conf. Proc. 14 (1928): 89. Providence, R. I.

Character of cankering on Douglas-fir and European larch is described. Removal and burning of all known infections to eradicate this introduced disease is the recommended method of control. The disease has been here 20 years but shows no signs of spreading from the affected plantations. The only other center of infection is in Rhode Island, where similar control is being taken to avoid possible spread of the disease.

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1930. SOME WOOD INHABITING FUNGI OF VERMONT. Vt. Bot. and Bird Clubs Joint Bul. 14: 28-50.

The author lists some 175 species collected in Vermont, by name, host, locality, and collector.

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1931. PREERADICATION SCOUTING--STOP, LOOK, AND LISTEN! Ann. Blister Rust Control Conf. Proc. 17: 27-28.

The author cautions against placing too much trust in Ribes eradication as an absolute control of white pine blister rust. He says that past experience indicates the possibility of an explosive outbreak of terrific intensity in which spores may be carried long distances to start new outbreaks.

* ---------- Hepting, G. H., and Westveld, M.
1931. SUGGESTIONS FOR ESTIMATING CULL IN NORTHERN HARDWOODS. Northeast. Forest Expt. Sta. Tech. Note 10. 3 pp. Amherst.

General instructions for estimating cull, based on studies in New England. Also specific instructions for sugar maple, soft maple, yellow birch, paper birch, and beech. Fomes igniarius, fomes nigricans, fomes connatus, and fomes applanatus are listed as the chief fungi; they are described briefly.

Spaulding, Perley, and MacAloney, H. J.
1931. A STUDY OF ORGANIC FACTORS CONCERNED IN THE DECADENCE OF BIRCH ON CUT-OVER LANDS IN NORTHERN NEW ENGLAND. Jour. Forestry 29: 1134-1149, illus.

The decline and death of paper birch and yellow birch after logging have been attributed to the bronze birch borer, the shoestring rot fungus, and other agents. Studies made in 1930 lead the authors to conclude that the cause is sudden exposure to light and heat. Exposure kills the upper crown of yellow birch, and paper birch is too old at time of release to sprout readily and recover its growth. The borer and the fungus are merely contributing causes of death; as decadence of the tree progresses, it becomes more susceptible to attack. The authors recommend that only relatively young birch be selected for release, and that such release be gradual.

* ---------- and MacAloney, H. J.
1931. ORGANIC FACTORS INVOLVED IN DECADENCE OF BIRCH ON CUT-OVER LANDS IN NORTHERN NEW ENGLAND. Northeast. Forest Expt. Sta. Tech. Note 9. 1 p. Amherst.

See above.

---------- and MacAloney, H. J.
1931. CAUSES OF DECADENCE OF BIRCH ON CUT-OVER LANDS IN NEW ENGLAND. U. S. Forest Serv. Forest Worker 7 (6): 16.

See above.

---------- and Hansbrough, J. R.
1932. THE SWEETFERN PITCH PINE BLISTER RUST, CRONARTIUM COMPTONIAE. U. S. Dept. Agr. Cir. 217. 21 pp., illus.

The sweetfern blister rust, so-called because one of the shrubs on which it passes its alternate stage of growth is the common sweetfern, attacks a number of 2- and 3-leafed pines. The rust is widely distributed, from Virginia north to Canada and in the coast range of British Columbia and Washington State. It has caused serious damage in nurseries, and should be considered when a nursery location is considered. No sweetfern or sweetgale should be tolerated within several hundred yards, and no large areas of either should be within 1 mile.

* Spaulding, Perley, Hepting, George H., and MacAloney, H. J.
1932. INVESTIGATIONS IN DECAYS OF BALSAM FIR. I. GALE RIVER EXPERIMENTAL FOREST, NEW HAMPSHIRE. Northeast. Forest Expt. Sta. Tech. Note 11. 3 pp. Amherst.

A discussion of decay found in cutting five ¼-acre plots on the Gale River Experimental Forest in New Hampshire. Red heart, brown butt rot, and stringy butt rot caused most of the cull. Carpenter ants attacked a considerable number of the trees. Direct relation between number of trees defective and age of the stand is shown.

---------- Hepting, G. H., and Westveld, M.
1934. REVISED SUGGESTIONS FOR ESTIMATING CULL IN NORTHERN HARDWOODS. Northeast. Forest Expt. Sta. Tech. Note 14. 3 pp. New Haven.

Revision of instructions published in 1931. See SPAULDING, HEPTING, and WESTVELD, 1931, Northeast. Forest Expt. Sta. Tech. Note 10, p. 115.

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1934. PERSISTENCE OF HEART-ROTTING FUNGI IN GIRDLED TREES. (Abstract.) Phytopathology 24: 17-18.

Five different species of heart-rotting fungi were found in trees girdled 2 to 5 years before. Enough fungi remained to serve as sources of infection for the young stand. Girdling or felling of infected trees will not completely kill these fungi unless the down stuff is disposed of.

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1935. LOPHODERMIUM PINASTRI CAUSING LEAFCAST OF NORWAY PINE IN NURSERIES. Northeast. Forest Expt. Sta. Tech. Note 18. 2 pp. New Haven.

A description of the disease, its life cycle, and its effect on pine seedlings. Bordeaux mixture double strength (4-4-25) and lime sulfur (2 percent) are recommended for control. Instructions for application are given. White pine has been resistant to this disease so far.

* Spaulding, Perley, MacAloney, H. J., and Cline, A. C.
1935. STEREUM SANGUINOLENTUM A DANGEROUS FUNGUS IN PRUNING WOUNDS ON NORTHERN WHITE PINE. Northeast. Forest Expt. Sta. Tech. Note 19. 2 pp. New Haven.

To avoid serious damage from attacks by this fungus, the authors recommend pruning before the branches exceed 2 inches in diameter. On larger branches it was found that the exposed heartwood was not well covered with protective pitch and so provided a favorable entrance for this fungus.

---------- Grant, T. J., and Ayers, T. T.
1936. INVESTIGATIONS OF NECTRIA DISEASES IN HARDWOODS OF NEW ENGLAND. Jour. Forestry 34: 169-179, illus.

The species most often attacked by Nectria are red maple, sweet birch, and yellow birch. American elm, white ash, white oak, and scarlet oak are not commonly cankered, but Nectria will go freely from one species to another. Moisture is an important factor. Whenever practical, cankered trees should be used for fuel and slash burned. Cankered trees should be removed in improvement programs, especially in sapling stands; but extensive measures are not worth while.

---------- and Scheffer, Theodore C.
1939. MINIMIZING LOSSES BY SAP STAIN AND DECAY IN WIND-THROWN TIMBER. U. S. Bur. Plant Indus., Div. Forest Path. 5 pp. New Haven.

Brief directions for minimizing losses in the salvaging of timber wind-thrown by the hurricane of September 1938. Methods are given for storing and protecting logs, lumber, and other forest products.

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1939. WOOD ROTS AS FACTORS BEFORE AND AFTER THE HURRICANE. Eastern Shade Tree Conf. Proc. 1938: 34-36.

Wood-rotting fungi are present wherever trees grow; the great number of tree wounds caused by the hurricane make these damaged trees liable to attack. Trees blown down or dying must be removed and utilized, and everything possible should be done to keep the survivors in good condition. Recommendations are made for handling lumber and slash and for treating survivors.

Spaulding, Perley.

1940. NECTRIA CANKER OF HARDWOODS (NECTRIA COCCINEA AND OTHER SPECIES). IN Important Tree Pests Of The Northeast. 132-135, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 10, 1936.)

A brief description of the fungus, its distribution, hosts, symptoms, cause, life history, and control. Nectria canker is widely distributed on ornamental and shade trees and in the hardwood forests of New England.

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1940. RED RING ROT OF CONIFERS (FOMES (TRAMETES) PINI (THORE) LLOYD). IN Important Tree Pests Of The Northeast: 165-168, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 17, 1937.)

A brief description of the fungus, its distribution, hosts, symptoms, cause, life history, and control. It is found throughout the North Temperate Zone.

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1940. ROOT ROTS OF CONIFERS (FOMES ANNOSUS FR. AND POLYPORUS SCHWEINITZII FR.). IN Important Tree Pests Of The Northeast: 169-172, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 18, 1937.)

Brief descriptions of these two common root rots of conifers in the Northeast, including distribution, hosts, symptoms, causes, life history, means of spread, and control.

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1940. WHITE TRUNK ROT OF HARDWOODS (FOMES IGNIARIUS (L. EX FR.) GILL.). IN Important Tree Pests Of The Northeast: 162-164, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 20, 1937.)

A brief description of the fungus, its history and distribution, hosts, symptoms, cause, life history and control. The fungus is generally and abundantly distributed in the hardwood forests of the entire North Temperate Zone.

Spaulding, Perley.

1940. SHOESTRING ROOT ROT OF CONIFERS AND HARDWOODS (ARMILLARIA MELLEA (VAHL.) QUEL.). IN Important Tree Pests Of The Northeast: 155-158, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 21, 1938.)

A brief description of the fungus, its distribution, hosts, symptoms and damage, cause, life history, and control. There seems to be almost no limit to the trees, shrubs, and vines that Armillaria mellea may attack.

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1940. SPONGY WHITE ROT OF HARDWOODS (FOMES CONNATUS (WEIMANN) GILLET). IN Important Tree Pests Of The Northeast: 159-161, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 38, 1939.)

A brief description of the fungus, its history and distribution, hosts, symptoms, causes, life history, and control. It attacks many hardwood species, and is rather common in the Northeast.

---------- and Hansbrough, J. R.

1943. THE NEEDLE BLIGHT OF EASTERN WHITE PINE. U. S. Bur. Plant Indus., Div. Forest Path. 2 pp. New Haven.

A description of the disease and its cause: dying of rootlets and imbalance between root system and crown. Fertilization and pruning may help trees recover, but only small trees can be treated this way.

* ---------- and Hansbrough, J. R.

1944. DECAY IN BALSAM FIR IN NEW ENGLAND AND NEW YORK. U. S. Dept. Agr. Tech. Bul. 872. 30 pp., illus.

More than 1,100 trees 40 or more years old were dissected and analyzed to determine the relation of cull to age, diameter, site factor, and growth rates. Decay severe enough to cause cull affected half the trees at 72 years and all at 165 years. About one-fourth of the total volume of all trees was cull. Most of the cull was due to three decays: top rot (Stereum sanguinolentum), brown butt rot (Polyporus balsameus) and white stringy butt rot (Poria subacida). Measures for managing balsam fir for pulpwood are recommended.

Spaulding, Perley.
1948. THE ROLE OF NECTRIA IN THE BEECH BARK DISEASE.
Jour. Forestry 46: 449-453, illus.

The Nectria associated with the beech bark disease of the Canadian Maritime provinces, Maine, and New Hampshire is discussed with reference to its action, known distribution, probable introduction from Europe, present status, and future spread. The importance of beech in northern New England is also discussed.

Waterman, Alma M., and Miller, J. Armstrong.
1936. A DIE-BACK OF DOUGLAS FIR.
Phytopathology 26: 804-805.

A disease that killed the terminal growth on the lower branches of Douglas-fir in 1935 on a Long Island estate was identified as a species of Sphaeropsis. This is the first recorded instance in the United States of Douglas-fir being attacked by this fungus.

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1941. DISEASES OF SHADE AND ORNAMENTAL TREES.
U. S. Dept. Agr. Plant Dis. Rptr. 25 (7): 181-186.

Annotated list of specimens received in 1940 at the New Haven office, Division of Forest Pathology.

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1943. DIPLODIA PINEA AND SPHAEROPSIS MALORUM ON SOFT PINES.
Phytopathology 33: 828-831.

Observations and inoculation tests indicate that neither fungus is parasitic upon the leaves and twigs of the new growth of young, vigorously growing white pines (Pinus strobus). Both fungi, however, occasionally may be contributing factors in the unhealthy condition of soft pines that have been weakened by other agencies. Improved growing conditions and the protection or prevention of wounds will lessen the possibility of infection.

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1943. DIPLODIA PINEA, THE CAUSE OF A DISEASE OF HARD PINES.
Phytopathology 33: 1018-1031, illus.

The disease of hard pines caused by Diplodia pinea (Desm.) Kickx (Sphaeropsis ellisii Sacc.) is widely distributed in the United States; it has not been known to cause any

extensive injury in forest stands but is of considerable importance on ornamental trees. Inoculations of young trees of Pinus nigra, P. sylvestris, P. resinosa, P. ponderosa, and P. strobus indicated that the fungus will infect healthy, actively growing tissues of buds and leaves but will infect more readily through wounds.

Waterman, Alma M.

1945. TIP BLIGHT OF SPECIES OF ABIES CAUSED BY A NEW SPECIES OF REHMIELLOPSIS. Jour. Agr. Res. 70: 315-337, illus.

Rehmiellopsis balsamea, a newly reported species, causes tip blight of native Abies balsamea, A. cephalonica, and A. concolor. Needles of current season's growth are attacked: dieback of terminal or lateral shoots may result, and cankers may be formed on twigs of A. concolor. Symptoms, morphology, taxonomy, cultural characteristics, pathogenicity, and control are discussed. Bordeaux mixture was found to be effective on ornamental white firs.

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1946. CANKER OF HYBRID POPLAR CLONES IN THE UNITED STATES, CAUSED BY SEPTORIA MUSIVA. Phytopathology 36: 148-156, illus.

Description of a canker disease of hybrid poplar clones in two plantings in New York State and in a planting of the Tennessee Valley Authority. Infection takes place through uninjured leaves and petioles or through twig wounds. On highly susceptible trees, cankers may girdle the stems; on less susceptible trees they may open avenues for infection by secondary fungi. The relative susceptibility of 10 hybrid poplar clones that have proved useful for reforestation was tested by inoculations.

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1947. RHIZOSPHAERA KALKHOFFI ASSOCIATED WITH A NEEDLE CAST OF PICEA PUGENS. Phytopathology 37: 507-511, illus.

Description of a fungus (not previously reported in the United States) that caused a severe needle cast of blue spruce in Connecticut. Bordeaux mixture proved a satisfactory control for ornamental trees.

Welch, D. S.
1934. THE RANGE AND IMPORTANCE OF NECTRIA CANKER ON HARDWOODS IN THE NORTHEAST. Jour. Forestry 32: 997-1002, illus.

Nectria canker is the most important disease of hardwoods in the Northeast. It attacks nearly all hardwood species and many of the larger shrubs. The canker rarely kills the trees, but it makes an open wound through which wood-destroying fungi and insects may enter.

## INSECTS

Baker, W. L., and Cline, A. C.
1936. A STUDY OF THE GYPSY MOTH IN THE TOWN OF PETERSHAM, MASSACHUSETTS, IN 1935. Jour. Forestry 34: 759-765.

In New England those species highly favored by gypsy moth larvae of all ages are the oaks, poplar, gray birch, alder, willow, and apple. The results of this study show that concentrations of these species accounted for the conspicuous defoliated areas in the town of Petersham. Complete defoliation was not observed in any instance where favored food trees constituted less than 50 percent of the stand. Recommendations are made for control of the gypsy moth through a program of silvicultural treatment.

* Behre, C. Edward, Cline, A. C., and Baker, W. L.
1936. SILVICULTURAL CONTROL OF THE GYPSY MOTH. Mass. Forest and Park Assoc. Bul. 157. 16 pp., illus.

Silvicultural measures designed to reduce the proportion of species favored as food by gypsy moth larvae are recommended by the authors as an effective and permanent control. Their study shows that serious defoliation is not likely to occur in hardwood stands where the favored tree foliage constitutes less than one-half of the total.

* Behre, C. Edward.
1939. THE OPPORTUNITY FOR FORESTRY PRACTICE IN THE CONTROL OF GYPSY MOTH IN MASSACHUSETTS WOODLANDS. Jour. Forestry 37: 546-551, illus.

The gypsy moth has become recognized as an established pest in Massachusetts. Control measures should be changed from those aimed at eradication to silvicultural methods of creating forest conditions unfavorable for serious outbreaks. Data from forest surveys in 1923 and 1924 have been analyzed and stands classified according to their resistance to gypsy moth.

---------- and Reineke, L. H.
1943. THE OPPORTUNITY FOR SILVICULTURAL CONTROL OF GYPSY MOTH IN SOUTHWESTERN MAINE. Jour. Forestry 41: 811-815, illus.

Wartime shortages of coal and oil give woodland owners an opportunity to cut and market fuel wood at a profit. Since favored food trees of the gypsy moth are generally the less valuable trees in the forest stands, these trees could be removed for fuel wood. At the same time, the stands would be improved and would be less attractive to gypsy moth. Guides for carrying out such work are given.

Brown, R. C.
1940. THE BEECH SCALE, CRYPTOCOCCUS FAGI (BAER.) DOUGL. IN Important Tree Pests Of The Northeast: 93-95, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 4, 1936.)

First discovered in the United States in Boston in 1929, the beech scale is now widely distributed through New England and lower New York. It appears on the trunks of American and European beech as white woolly dots that may become numerous enough to form solid masses. Damage is not serious, although patches of dead bark may result from heavy infestations. It can be controlled with a dormant spray of lime-sulfur, but this is impractical in large forest areas. Natural controls are low winter temperatures and the ladybird beetle.

Hall, Ralph C.
1928. THE BRONZE BIRCH BORER.
U. S. Forest Serv. Forest Worker 4 (4): 16-17.

A brief discussion of the bronze birch borer (Agrilus anxius Gory), symptoms of infestations, and damage caused. Research agencies working on the problems are listed.

MacAloney, Harvey J.
1926. THE WHITE PINE WEEVIL PROBLEM IN THE NEW ENGLAND STATES. Forest Protect. Conf. Proc. 1926: 31-43, illus. Syracuse.

A description of the weevil, its life history, and the damage it does in different type forests. Methods of control are described. The author urges that white pine be grown in mixture with hardwoods or hemlock.

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1928. MIXED STANDS THE BEST PROTECTION AGAINST WHITE PINE WEEVIL. U. S. Forest Serv. Forest Worker 4 (2): 13.

The best and cheapest way to protect northern white pine from the weevil is to grow it in mixture with other species. In central New England a mixture with hardwoods offers excellent protection.

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1929. THE WHITE PINE WEEVIL AS A SHADE TREE PEST.
Natl. Shade Tree Conf. (5th) Proc. 1929: 69-72.

The white pine weevil is a serious pest because it damages the shape of shade trees. There are two ways to control weevil damage to shade trees: (1) make the leaders unfavorable to attack by using repellents or poisonous sprays; (2) band the leaders with some material that will prevent the weevils from reaching the leaders except by flying. Infested leaders should be removed and burned.

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1930. WEATHER CONDITIONS A FACTOR IN WHITE PINE WEEVIL INJURY. U. S. Forest Serv. Forest Worker 6 (1): 18.

Weather affects not only development of the egg but also resumption of spring activity by hibernating adults. Two winters (1927-28 and 1928-29) and their effects on the weevil are described.

MacAloney, Harvey J.
1930. THE WHITE PINE WEEVIL (PISSODES STROBI PECK)--ITS BIOLOGY AND CONTROL. N. Y. State Col. Forestry Tech. Pub. 28. 87 pp., illus. Syracuse.

A comprehensive report on the weevil, including a description of the damage it does, historical notes, life history, and methods of control. Based on a study begun in 1923 and completed in 1928.

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1932. THE WHITE PINE WEEVIL.
U. S. Dept. Agr. Cir. 221. 30 pp., illus.

The white pine weevil is the most serious pest that attacks northern white pine. This bulletin describes the life history and characteristics of the weevil. Means of control and type and extent of damage are discussed.

(---------- and Johnston, J. W.)
1932. WEEVIL DOES LITTLE HARM TO RIGA PINE.
U. S. Forest Serv. Forest Worker 8 (3): 9.

Brief mention of a study by MacAloney and Johnston, who found that of 3,386 trees examined, 1,110 had been attacked, but only 39 (1.15 percent) had died. Resistance is attributed to vigor and heavy flow of sap.

* ---------- and Johnston, J. W.
1932. WHITE-PINE WEEVIL ATTACK ON SCOTCH PINE.
Northeast. Forest Expt. Sta. Tech. Note 12. 2 pp.
Amherst.

White-pine weevil attacks scotch pine. However, a variety of scotch pine (Riga) survives the attack. Of the 3,386 trees examined in plantations of Riga pine in the Northeast, 1,110 were attacked but only 39 were damaged seriously.

---------- and Johnston, J. W.
1933. WHITE-PINE WEEVIL ATTACK ON SCOTCH PINE.
Jour. Forestry 31: 26-28.

More detail than above. The authors conclude that resistance of Riga pine is due to the vigorous growth of the strain, and the consequent heavy flow of pitch.

MacAloney, H. J., and Hosley, N. W.
1934. EXPERIMENTS IN SIMPLIFIED CONTROL OF MOUND-BUILDING ANTS IN THE FOREST. Jour. Forestry 32: 1003-1006.

Carbon disulfide or ethylene dichloride, if properly used, will control the mound-building ant (Formica exsectoides Forel). One to two pounds of these chemicals are necessary for each mound. Treatment should be done in late fall or early spring when all ants are in the mound.

* ----------
1935. PREVENTION OF DAMAGE TO ROUND-EDGED WHITE PINE LUMBER BY WOOD-BORING INSECTS. Northeast. Forest Expt. Sta. Tech. Note 21. 2 pp. New Haven.

Three species of borers are involved: the sawyer beetles Monochamus scutellatus Say and M. notatus Drury and the black-horned pine borer Callidium antennatum Newm. The first two attack green logs and lumber; the other attacks seasoned or partially seasoned material. Lumber sawed in fall and winter should be used the next spring and early summer; lumber sawed in spring should be used before September. No sawing should be done in June-August unless there is immediate use for the material.

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1935. THE BALSAM WOOLLY APHID IN THE NORTHEAST. Jour. Forestry 33: 481-484, illus.

The balsam woolly aphid, or fir-bark louse, Adelges (Dreyfusia) piceaa Ratz., is well established throughout the range of balsam fir in New England. Control of the insect in forested areas will be difficult, if not impossible. Where balsam fir is an appreciable part of the stand, severe infestations will greatly reduce the value of the crop.

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1936. THE EUROPEAN SPRUCE SAWFLY. Natl. Shade Tree Conf. Proc. 12: 145-150.

The first severe infestation by the sawfly was identified in the Gaspe Peninsula in 1930. By 1936 some 6,000 square miles of forest were heavily defoliated. White spruce is the favored host, but other spruces are also attacked. Three generations of the insect per year are common in Connecticut, but in northern Maine there is only one. Larvae generally feed on older needles but will also consume current year's needles when mature. Control by parasites gives promise in forested areas, but insecticides are too expensive except for shade trees.

MacAloney, H. J., and Dowden, Philip B.
1940. EUROPEAN SPRUCE SAWFLY (DIPRION POLYTOMUM HARTIG). IN Important Tree Pests Of The Northeast: 7-12, illus. Mass. Forest and Park Assoc. Boston. (Originally published as Tree Pest Leaflet 4, 1936.)

Description of the European spruce sawfly, its history and distribution, rate of spread, hosts, symptoms, control, predators, and parasites.

Peirson, H. B.
1924. ESTIMATING FOREST INSECT DAMAGE.
Maine Forest Serv. Bul. 3. 22 pp.

A summary of investigations made in spruce and fir stands following the spruce budworm epidemic of 1910-20. The discussion relates primarily to budworm damage, but results could apply to most other insect attacks. The author describes the procedures by which he estimated mortality and retardation of growth due to defoliation. Reduction of growth rate in surviving trees was found to be equivalent to a complete loss of from 4 to 8 years' growth, and was not offset by any release effect from killing of part of the stand. The rate of deterioration of timber killed by defoliation varied directly with rate of growth before attack.

* Westveld, Marinus, and Pearson, Jack.
1947. THE BUDWORM IS BACK.
Soc. Protect. N. H. Forests. 16 pp., illus. Concord.

A popular type booklet telling what the budworm is, how it breeds, and the damage it does to spruce-fir forests. Timberland owners in the spruce-fir region are urged to harvest all balsam fir 12 inches or more in diameter, and to cut other diseased trees, spruce as well as fir, regardless of size, to leave forests of young fast-growing trees that can better resist the budworm. Westveld's formula is offered for determining how vulnerable to budworm a forest stand is.

(NOTE: For reports on other studies about the spruce budworm, methods of evaluating the hazard, and silvicultural methods of combatting it, see McLINTOCK, pp. 51-52, 71, and WESTVELD, pp. 54, 76.)

# ANIMALS AND BIRDS

Behre, C. Edward, and others.
1929. GRAZING IN RELATION TO FORESTRY IN NEW ENGLAND. Jour. Forestry 27: 602-608.

No kind of stock can be grazed in the forest without some damage to the forest. The damage may be reduced to such small proportions that it is more than offset by the benefits from grazing in coniferous plantations on old fields or open lands or naturally restocked areas of the same kind. Grazing is not advisable in sugar maple orchards as this tends to destroy the orchard.

Hazen, J. F., and Wood, O. M.
1935. ANIMAL DAMAGE IN RELATION TO SIZE OF PLANTING STOCK. Allegheny Forest Expt. Sta. Tech. Note 4. 2 pp. Philadelphia.

Pine plantations in Burlington County, New Jersey, suffered 20.7 percent damage from browsing by animals, most of it during the first winter after planting. Although deer were seen on the area, the authors attribute most of the damage to rabbits. A portion of the area enclosed by a 2-foot fence of 1-inch wire mesh escaped damage completely.

* Hough, A. F.
1949. DEER AND RABBIT BROWSING AND AVAILABLE WINTER FORAGE IN ALLEGHENY HARDWOOD FORESTS. Jour. Wildlife Mangt. 13 (1): 135-141, illus.

Studies on fenced and unfenced plots at Kane Experimental Forest indicate that rabbits damage the low cover of trees and shrubby browse much more than deer do. Under complete protection a remarkable recovery of browse species takes place in 5 to 10 years, but only slight recovery took place when deer alone were excluded. Where markets for pulpwood exist, a combination of natural predator control of rabbits and stand-improvement thinnings will help to build up winter browse and increase forest productivity.

* Little, Silas Jr.
1937. DEER DAMAGE TO PINE REPRODUCTION IN SOUTHERN NEW JERSEY. Allegheny Forest Expt. Sta. Tech. Note 19. 2 pp. Philadelphia.

A discussion of deer damage on natural reproduction of pitch, shortleaf, and Virginia pine in the oak-pine type in

southern New Jersey. Damages are presented by species, six height classes, and three damage classes.

Lutz, H. J.
1930. EFFECT OF CATTLE GRAZING ON THE VEGETATION OF A VIRGIN FOREST IN NORTHWESTERN PENNSYLVANIA. Jour. Agr. Res. 41: 561-570, illus.

Grazing caused direct injury to vegetation. Damage consisted of browsing, breakage, root injuries, and pulling of small trees out of the soil. Grazing damage varied according to species and caused a reduction in number of trees, basal area, and herbaceous plants. Surface soil was compacted and the amount of organic debris on the forest floor was reduced.

* Ostrom, C. E.
1937. DEER AND RABBIT INJURY TO NORTHERN HARDWOOD REPRODUCTION. Allegheny Forest Expt. Sta. Tech. Note 15. 2 pp. Philadelphia.

Results of first-year examination of study plots in northern hardwood-hemlock in northwestern Pennsylvania. Presents information on deer and rabbit damage for five tree species and four habitats.

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1937. WHERE DO DEER AND RABBITS FEED?
Pa. Game News 8 (8): 15, 30.

A study of the feeding habits of deer and rabbits with respect to young trees and woody shrubs indicated that deer browsing was most frequent in young second-growth forests and in the open. Very little deer browsing was noted in culled old-growth stands. The degree of utilization by deer was found to range from 0.1 percent to 47 percent, depending upon the habitat. Rabbit browsing was most frequent in the open. Rabbits browsed more selectively than deer. They fed heavily on red maple.

Pearce, John, and Reineke, L. H.
1940. RABBIT FEEDING ON HARDWOODS.
Northeast. Forest Expt. Sta. Tech Note 35. 3 pp. New Haven.

Observations in young hardwood plantations in Massachusetts and natural stands in Maine showed that rabbits, in feeding, have preferences for certain species. They preferred Kentucky coffeetree, honey locust, and hardy catalpa to black locust, hackberry, and red

mulberry. They preferred beech, maples, and serviceberry to birches and balsam fir. They generally fed on small stems, 1 inch d.b.h. or smaller.

Stewart, Guy R.
1933. FOREST PLANTATIONS INJURED BY ROOSTING BIRDS. Jour. Forestry 31: 421-423, illus.

Defoliation and death of pine trees in plantations used by large numbers of roosting birds is caused by accumulation of excessive amounts of nitrate oxygen from bird droppings under the trees. Roosting can be discouraged by the use of noise, lights, or strong streams of water against birds protected by law. Unprotected species can best be reduced by the use of firearms.

Stickel, Paul W., and Hawley, Ralph C.
1925. THE GRAZING OF CATTLE AND HORSES IN PINE PLANTATIONS. Jour. Forestry 23: 389-391.

The authors argue that under certain conditions grazing can be beneficial in pine plantations because it reduces the fire hazard. Grazing was recommended only until the plantation becomes closed (7 to 12 years after establishment).

## HARMFUL PLANTS

Jackson, L. W. R., and Kaplan, F.
1938. DODDER DAMAGES BLACK LOCUST SEEDLINGS AT A PENNSYLVANIA NURSERY. Jour. Forestry 36: 712.

Black locust seedlings infected with dodder were considerably retarded in growth and finally killed. Spread of the dodder was prevented by cutting and burning affected seedlings.

# MENSURATION

## GENERAL

Behre, C. Edward.
1925. FOREST MENSURATION TO-DAY.
Jour. Forestry 23: 287-289.

Forest mensuration prior to 1925 satisfied the needs of the moment but increased emphasis will have to be placed on office work to achieve results of a more permanent value. Further, the field work will have to be done on a more scientific basis.

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1926. COMPARISON OF DIAMETER TAPE AND CALIPER MEASUREMENTS IN SECOND GROWTH SPRUCE. Jour. Forestry 24: 178-182.

A comparative study of caliper and diameter-tape measurements was made on spruce on Mt. Desert Island, Maine. There was practically no difference between the results obtained with the two instruments.

* Camp, H. W., Jr., and Bickford, C. A.
1949. BINOCULARS WITH MIL SCALE AS A TRAINING AID FOR ESTIMATING FORM CLASS. Northeast. Forest Expt. Sta. Paper 32. 11 pp., illus. Upper Darby.

Describes a method for using binoculars with mil scale for measuring diameter outside bark at top of first sawlog and thus determining form class. Getting into proper position and measuring the tree with mil scale are illustrated in a series of diagrams.

* Cunningham, F. E., Filip, S. M., and Ferree, M. J.
1947. RELATION OF TREE STUMP DIAMETER TO DIAMETER BREAST HIGH. Northeast. Forest Expt. Sta. Note 1. 3 pp. Philadelphia.

In the Anthracite Region of Pennsylvania a large amount of stumpage is sold on a stump-diameter basis. Since most volume tables are based on diameter at breast height, a way is needed to convert these stump diameters to d.b.h. The authors offer conversion tables for doing this.

Ferree, Miles J.
1946. THE POLE CALIPER.
Jour. Forestry 44: 594-595.

The author constructed a pole caliper to measure tree diameters at the top of the first 16-foot log, a measurement needed in constructing volume tables in accordance with the Girard form class. The pole caliper consists of an ordinary 24-inch tree caliper mounted on a 12-foot pole. A string opens and closes the jaws.

Hetzel, John E.
1939. AN EXTENSION ROD FOR MEASURING TREE HEIGHTS.
Jour. Forestry 37: 494-495, illus.

Describes a light and inexpensive sectional rod that can be made for measuring tree heights in plantations. The rod is graduated so that height may be read at the base of the last section of the rod raised.

* Hough, A. F.
1930. STUMP DIAMETER-D.B.H. RELATIONSHIP FOR BEECH IN NORTHWESTERN PENNSYLVANIA. Allegheny Forest Expt. Sta. Tech. Note 1. 2 pp. Philadelphia.

A method and chart for determining diameter breast high from beech stumps, so that d.b.h. volume tables can be used when only stump diameters are available.

Meyer, W. H.
1926. METHODS OF READING MULTIPLE QUANTITIES FROM CURVES.
Jour. Forestry 24: 547-551.

Two short cuts are given for interpolating within a table and multiplying the interpolated value by another number. In the first case, the table is plotted on log-log paper and a strip with the same graduations is used as a slide rule. In

the second case, the table is plotted on rectangular coordinates and an alinement chart is added to do the multiplying.

* Morey, H. F.
1931. A TEST OF HYPSOMETERS ON SHORT TREES.
Jour. Forestry 29: 233-237.

Comparisons were made of the Abney level and the Klaussner, Faustmann, and Forest Service hypsometers to determine their relative advantages. It was found that for heights of 50 feet or less the Abney level and the Forest Service hypsometer were most accurate and dependable.

* Ostrom, C. E., and Taylor, L. E.
1938. RELATION OF STUMP DIAMETER TO BREAST-HIGH DIAMETER OF NORTHERN HARDWOODS. Allegheny Forest Expt. Sta. Tech. Note 23. 2 pp. Philadelphia.

Data collected in 30- to 40-year-old second-growth stands in Elk County, Pennsylvania, show a straight-line relationship between diameters at stump and breast height. The data are summarized in alinement charts for beech, black cherry, sugar maple, and yellowpoplar.

* Reineke, L. H.
1932. A PRECISION DENDROMETER.
Jour. Forestry 30: 692-699, illus.

A simple, inexpensive dendrometer was devised by the author. The head of a wood screw driven into the bark is the movable point. The fixed point is a hook screw driven into the xylem. The fixed hook screw is located at a distance great enough from the movable point to insure that improper readings are not taken because of injured cambium. A dial-gage micrometer is used to measure the distance from the fixed screw to the movable screw.

---------- and Bruce, Donald.
1932. AN ALINEMENT-CHART METHOD FOR PREPARING FOREST-TREE VOLUME TABLES. U. S. Dept. Agr. Tech. Bul. 304. 28 pp., illus.

The method is to adjust an alinement chart for cylindrical volume to that of a tree by including influence of form as it varies with d.b.h. and height for the particular data. Other standard solids may be used as a base, and tree volume may be expressed in board feet, cubic feet, or other units for the entire stem or merchantable portion.

* Reineke, L. H.
1935. DISCUSSION OF DEMERITT AND McINTYRE'S METHOD OF CONSTRUCTING TREE VOLUME TABLES. Jour. Forestry 33: 412-418, illus.

Criticism of an alinement-chart method of preparing tree-volume tables, for which speed, accuracy, and simplicity are claimed. Reineke says the proposed method is fundamentally unsound, and when the technical errors in the method are corrected the method has no advantages over the base-chart method it is designed to supplement.

Rulison, Donald E.
1940. A USEFUL MULTIPLE TALLY REGISTER HOLDER. Jour. Forestry 38: 659-660, illus.

Three tally registers combined into a simple device provide an effective means of tallying three kinds of information. Its use in counting numbers of trees is described briefly. Details of construction are shown.

## MEASUREMENT OF STANDS

Allegheny Forest Experiment Station.
1942. VOLUME TABLES FOR COMMERCIAL TIMBER IN THE ANTHRACITE REGION OF PENNSYLVANIA. Allegheny Forest Expt. Sta. Anthracite Survey Paper 4. 27 pp., illus. Philadelphia.

Trees of the same species or same group of species do not have similar tapers. To overcome this and other related variances in estimating volume, tables were prepared on the basis of merchantable height (by 16-foot logs) and taper as indicated by the Girard form class for saw timber and the Girard form point for cubic-foot volumes. Although they were prepared for use in the Anthracite Region of Pennsylvania, the tables may be adapted to other areas in the East.

Behre, C. Edward.
1923. PRELIMINARY NOTES ON STUDIES OF TREE FORM. Jour. Forestry 21: 507-511.

The application of Swedish form-class methods of timber estimating to American tree species was studied with the idea of determining whether the universal character of the

volume and taper tables based on four classes constructed by Tor Jonson would be useful in working out problems of growth and yield in this country. As a result of the study, a new equation evolved, having the form of the ordinary hyperbola and giving a more consistent universal expression of form than the Swedish methods.

Behre, C. Edward.
1924. IS TAPER BASED ON FORM QUOTIENT INDEPENDENT OF SPECIES AND SIZE? Jour. Forestry 22: 282-290, illus.

The author discusses W. G. Wright's method of calculating form class and shows how the data can be used to eliminate root swell. The author concludes that there is no need for separate taper series for different species and different sizes when root swell is taken into consideration.

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1926. CHARTS FOR APPLICATION OF PERCENTILE TAPER CURVES TO TREES OF ANY SIZE CLASS. Jour. Forestry 24: 272-274, illus.

Percentile taper curves show the percentage relationship of inside-bark diameters at various heights to inside-bark diameter at breast height. The author describes Hohendal's method of transforming such curves for reading diameters directly in inches instead of percentages.

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1927. FORM CLASS TAPER CURVES AND VOLUME TABLES AND THEIR APPLICATION. Jour. Agr. Res. 35: 673-744, illus.

In Sweden, form-class volume tables have been developed from a formula devised by Hojer to express general law of taper. The author reports on studies of the method based on measurements of western yellow pine (ponderosa pine) and spruce and fir. He reports good fit of formula for several American species. Advantages of the method are listed.

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1935. FACTORS INVOLVED IN THE APPLICATION OF FORM-CLASS VOLUME TABLES. Jour. Agr. Res. 51: 669-713, illus.

Report on a study based on measurements of 2,189 spruce and fir. Author concludes form-class volume tables have little advantage because so much variation in form, bark thickness, and butt swell is associated with d.b.h. and height and these factors are shown in conventional tables.

Bickford, C. A.
1948. HOW TO CHECK AND CONSTRUCT VOLUME TABLES. Northeast. Forest Expt. Sta. 7 pp., illus. Upper Darby.

Description of statistical methods for use in (1) checking available volume tables to determine if they are suitable for local use, and (2) constructing new tables. A quick way to compute tree volume is also suggested.

* Burnham, C. F., Ferree, M. J., and Cunningham, F. E.
1946. SITE CLASS VOLUME TABLES FOR MERCHANTABLE TIMBER IN THE ANTHRACITE REGION OF PENNSYLVANIA. Northeast. Forest Expt. Sta. Forest Management Paper 3. 16 pp. Philadelphia.

These volume tables were prepared especially for use on small tracts. The tables, given for three site classes, include the following: gross board-foot volume, gross cubic-foot volume, and gross weight in tons per tree. Accuracy of volume measurements on 100 trees or more is within 2 percent.

* Hough, A. F.
1932. SOME DIAMETER DISTRIBUTIONS IN FOREST STANDS OF NORTHWESTERN PENNSYLVANIA. Jour. Forestry 30: 933-943, illus.

The frequency distribution by diameters of even-aged stands tends to approximate the normal curve of error while that of all-aged stands is J-shaped. Diameter distributions of white pine were roughly normal in second-growth and virgin stands, even in stands that were neither fully stocked nor pure. Diameter distributions of hemlock were J-shaped.

* Meyer, E. F.
1937. VOLUME TABLES FOR PLANTATION-GROWN WHITE PINE (PINUS STROBUS, L.) Allegheny Forest Expt. Sta. Tech. Note 16. 2 pp. Philadelphia.

Two volume tables (cubic feet) for white pine plantations in Maryland, prepared in connection with a study of thinnings in a mixed white pine and yellowpoplar plantation on the Loch Raven watershed of the city of Baltimore, Md. For small trees, 20 to 50 feet high.

* Meyer, E. F.
1937. VOLUME TABLES FOR PLANTATION-GROWN YELLOW POPLAR (LIRIODENDRON TULIPIFERA L.). Allegheny Forest Expt. Sta. Tech. Note 17. 2 pp. Philadelphia.

Two volume tables (cubic feet) for yellowpoplar plantations in Maryland, prepared in connection with a study of thinnings in a mixed white pine and yellowpoplar plantation on the Loch Raven watershed of the city of Baltimore, Md. For small trees, 25 to 60 feet high.

* Ostrom, C. E.
1940. PULPWOOD VOLUME TABLES FOR SECOND GROWTH BLACK CHERRY, SUGAR MAPLE, AND BEECH IN NORTHWESTERN PENNSYLVANIA. Allegheny Forest Expt. Sta. Tech. Note 30. 2 pp. Philadelphia.

Charts for relating peeled merchantable volume to diameter outside bark. Data for site I cherry, beech, and maple were developed during a pulpwood cost study in well-stocked stands 40-45 years old.

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1942. PULPWOOD VOLUME TABLE FOR BEECH POLES. Allegheny Forest Expt. Sta. Tech. Note 36. 1 p. Philadelphia.

A volume table in cubic feet for the stem and main forks, less bark, of beech poles. For use in scaling pulpwood before bucking and piling.

* Schnur, G. L.
1934. DIAMETER DISTRIBUTIONS FOR OLD-FIELD LOBLOLLY PINE STANDS IN MARYLAND. Jour. Agr. Res. 49: 731-743, illus.

Diameter distributions of old-field loblolly pine (from records of 34 plots established in Maryland in 1906) are described by formulae and graphs. Only numbers of trees and standard deviations varied significantly with diameter of average tree. Frequency distribution was best described by Pearson's type I curve. Final presentation is in the form of an alinement chart for easier use.

Schnur, G. Luther.
1939. VOLUME TABLES FOR LOBLOLLY PINE (PINUS TAEDA L.). Allegheny Forest Expt. Sta. Tech. Note 25. 3 pp. Philadelphia.

Three tables: (1) entire stem less bark, cubic feet, (2) merchantable stem with bark, cubic feet, and (3) board feet 1/8-inch International rule. The tables were devised primarily for analyzing permanent sample plots on the Eastern Shore of Maryland.

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1940. VOLUME TABLES FOR SUGAR MAPLE (ACER SACCHARUM MARSH.). Allegheny Forest Expt. Sta. Tech. Note 28. 1 p. Philadelphia.

A cubic-foot volume table computed from data gathered principally in the Allegheny Plateau of northwestern Pennsylvania.

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1940. VOLUME TABLE FOR BEECH (FAGUS GRANDIFOLIA EHR.). Allegheny Forest Expt. Sta. Tech. Note 29. 1 p. Philadelphia.

A cubic-foot volume table computed in connection with analyses of permanent sample-plot records on the Kane Experimental Forest in northwestern Pennsylvania in 1936.

Trimble, George Richardson, Jr.
1940. MEASURING SAMPLE TREES ON A TIMBER MANAGEMENT SURVEY. Jour. Forestry 38: 518-519.

Proposes crew organization and procedures for collecting sample-tree data for use in constructing local volume tables and predicting growth.

# MEASUREMENT OF PRODUCTS

* Fenton, R. H.
1948. WOOD CONTENT OF STACKED 4-FOOT ROUND PULPWOOD IN CONNECTICUT. Northeast. Forest Expt. Sta. Paper 17. 8 pp., illus. Upper Darby.

Description of a method for measuring the actual wood content of stacks of pulpwood. A photograph is made of the ends of the sticks in the stack, with a dot grid superimposed. Counts are made of the dots falling on solid wood, bark, or air space; and from the dot count the volume of solid wood is estimated.

McIntyre, Arthur C., and Schnur, G. Luther.
1931. THE MEASUREMENT OF THE MINE PROPS, LINEAR FOOT, TOP DIAMETER, WEIGHT AND VOLUME TABLES. Pa. Agr. Expt. Sta. Bul. 269. 24 pp., illus.

In the mining sections of Pennsylvania many forest products are bought and sold by the piece, linear foot, or by weight. To give timber operators dealing in these products some basis for estimating the volume of mine props, ties, and timbers in a forest stand the authors have assembled a series of charts and tables prepared from actual measurements and weights obtained from many felled trees in several sections of the state. Merchantable-height tables and tables of weight per linear foot and diameter for red, white, scarlet, black and chestnut oak, hard and soft maple, black cherry, and yellow and black birch.

* Reineke, L. H.
1940. EFFECT OF STICK LENGTH ON CORDWOOD VOLUME. Northeast. Forest Expt. Sta. Tech. Note 34. 2 pp. New Haven.

Measurements of some 50 cords of stacked northern hardwoods cut in 4-foot lengths, then bucked into 16- and 12-inch sticks, show that the variation in the net cubic content per cord of 4-foot wood is due primarily to species differences. When the same wood is bucked into short lengths, however, the variations disappear and a high degree of uniformity in solid content results.

Schnur, G. Luther.
1932. CONVERTING FACTORS FOR SOME STACKED CORDS. Jour. Forestry 30: 814-820, illus.

Report on study of the amount of solid wood per cord, according to tree diameter. The author concludes that only one converting factor--73±5 cubic feet per standard cord--need be used, regardless of diameter class, if all sticks thicker than 8 inches are split.

## GROWTH AND YIELD

Behre, C. E.
1925. NOTES ON CAUSE OF ECCENTRIC GROWTH IN TREES. Jour. Forestry 23: 504-507, illus.

From stem and crown analyses made on red and white spruces the author concludes that gravity (as in trees having crowns largely on one side at the bole) or other mechanical stimuli are the chief causes of eccentric growth in the stem, rather than the uneven distribution of photosynthetic activity.

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1932. CHANGE IN FORM OF RED SPRUCE AFTER LOGGING. Northeast. Forest Expt. Sta. Tech. Note 13. 2 pp. Amherst.

Detailed measurements taken on a number of red spruce trees in a mixed stand of spruce and hardwoods in New Hampshire show that change in form after selective cutting will depend upon the character of the individual trees left. In general, little or no significant change in the average form quotient may be expected, because trees at either extreme tend to approach a common mean.

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1932. CHANGE IN FORM OF RED SPRUCE AFTER LOGGING AND OF NORTHERN WHITE PINE AFTER THINNING. Jour. Forestry 30: 805-810, illus.

In selectively cut stands of the spruce-yellow birch type, the residual spruces tend to approach a common mean form quotient of 70. Young even-aged stands of white pine that have been heavily thinned from below generally show an average increase in form quotient. In general, the change of form after cutting is closely correlated with the form quotient at the time of cutting.

Hough, A. F.
1935. A METHOD OF PREPARING WOOD SECTIONS FOR ACCURATE AGE COUNTS. Jour. Forestry 33: 698-699.

Hand rubbing proved satisfactory on small cross sections, but not on V-cuts more than 12 inches long. These were smoothed more easily with the use of a ½-hp. motor. A variety of stains were applied to accentuate annual rings. Rings as close as 50 per radial inch were examined successfully under a 30x magnification (binocular microscope) using direct light.

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1935. RELATIVE HEIGHT GROWTH OF ALLEGHENY HARDWOODS. Allegheny Forest Expt. Sta. Tech. Note 6. 2 pp., illus. Philadelphia.

A table showing total height of 10 species (1,373 trees) from 1 inch d.b.h. Measurements made in Warren County, Pennsylvania. Practical use is in reading heights of trees for a known d.b.h.

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1935. CROWN SPREAD OF ALLEGHENY HARDWOODS. Allegheny Forest Expt. Sta. Tech. Note 7. 1 p., illus., Philadelphia.

Study of crown spread in relation to diameter of seven species (570 trees) in Warren County, Pennsylvania, shows that small tolerant species under suppression produced flat, wide crowns, whereas intolerant species produced long, narrow crowns. For a given diameter the intolerant species tend to occupy less crown space than do the tolerants.

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1936. HEIGHT GROWTH OF HEMLOCK AND HARDWOOD SEEDLINGS IN A VIRGIN STAND ON EAST TIONESTA CREEK. Allegheny Forest Expt. Sta. Tech. Note 12. 2 pp., illus. Philadelphia.

A table showing the number of years required for seedlings of average growth rate to reach various heights in a virgin forest. This is useful in correcting ages counted on the stump or at breast height to total age.

Jensen, Victor S.
1941. EIGHT YEARS GROWTH IN HARDWOOD STANDS ON THE BARTLETT EXPERIMENTAL FOREST. Northeast. Forest Expt. Sta. Tech. Note 43. 4 pp. New Haven.

Report on an inventory of the Bartlett forest (on which little cutting had been done since 1900) following the hurricane in 1938. Net average annual increment for the 8-year period was approximately 0.4 cord per acre per year.

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1941. EIGHT YEARS GROWTH IN HARDWOOD STANDS ON THE BARTLETT EXPERIMENTAL FOREST. Pulp and Paper Mag. Canada 42(13): 797-798.

See above.

Meyer, W. H.
1929. YIELDS OF SECOND-GROWTH SPRUCE AND FIR IN THE NORTH-EAST. U. S. Dept. Agr. Tech. Bul. 142. 52 pp., illus.

From site index curves based on height of the average dominant tree at different ages and related to basal area per acre, yield tables were developed for each site class. Other stand characteristics such as trees per acre, size of average tree, and volume per acre are also shown by site classes. Normal volume tables have been developed for form classes 65, 70, and 75.

Morey, H. F.
1932. WHAT IS THE GROWTH PER CENT OF AMERICAN FORESTS? Jour. Forestry 30: 424-428.

Growth percent was computed for 17 American tree species for the age at which mean annual growth in board feet culminated. The rates of growth at this age ranged from 7.7 percent for cottonwood in the Mississippi Valley to 0.8 percent for lodgepole pine in the Rocky Mountains.

Reineke, L. H.
1933. PERFECTING A STAND-DENSITY INDEX FOR EVEN-AGED FORESTS. Jour. Agr. Res. 46: 627-638, illus.

For Douglas-fir, white fir, red fir, and the four southern yellow pines frequency curves were prepared showing number of trees per acre at full density for varying average diameters and stand ages. A "reference curve" was developed,

by which the relative density of any even-aged stand can be expressed percentage-wise.

* Schnur, G. L.
1937. YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS. U. S. Dept. Agr. Tech. Bul. 560. 87 pp., illus.

The upland oak region comprises about 100 million acres in the eastern United States, of which about 0.3 percent is in virgin forest. This bulletin gives statistical data necessary for the management of these forests. On average and excellent sites yields of 21,000 and 34,000 board feet per acre can be expected in 100 years with extensive management.

Simmons, E. M., and Schnur, G. L.
1937. EFFECT OF STAND DENSITY ON MORTALITY AND GROWTH OF LOBLOLLY PINE. Jour. Agr. Res. 54: 47-58, illus.

Data collected from 44 plots laid out in old-field stands in Maryland in 1906 show mortality and growth in even-aged loblolly pine are significantly correlated with stand density and basal area. From these factors, growth and mortality may be predicted for 5-, 10-, and 15-year periods. Maximum suggested interval between thinnings is 15 years.

Spaulding, Perley.
1937. ESTIMATING THE LENGTH OF TIME THAT TREES HAVE BEEN DEAD IN NORTHERN NEW ENGLAND. Jour. Forestry 35: 393-395, illus.

The appearance of fungi can be used in estimating the time that trees have been dead. Single fruiting bodies of Fomes applanatus or F. pinicola may occur on the trunk 3 years after death. In the fourth year several fruits may form. Two years after death single scattered small annual brackets of many fungi appear, with dozens appearing by the fourth year. For rot-resistant species, and for a cool-wet or a warm-dry condition, allow 2 additional years.

> Note: For estimating cull from fungal infections, see SPAULDING, HEPTING AND WESTVELD, Northeast. Forest Expt. Sta. Tech. Note 10, 1931 (p. 115) and Northeast. Forest Expt. Sta. Tech. Note 14, 1934 (p. 117).

Stickel, P. W., and Hawley, R. C.
1924. COMPARATIVE BASAL AREAS.
Jour. Forestry 24: 302-305.

Using basal area as an indication of the density of stocking of which the species are capable, the authors compared basal area in sample plots containing chestnut and chestnut oak, then expanded their study to include 13 other hardwoods and 15 conifers, for which they obtained basal area data from yield tables.

Turberville, H. W., and Hough, A. F.
1939. ERRORS IN AGE COUNTS OF SUPPRESSED TREES.
Jour. Forestry 37: 417-418.

A count of annual rings is not always an accurate record of tree age. A study in the Allegheny National Forest showed that some annual rings were missing in suppressed or very slow-grown trees. This was evidenced in cross sections cut at different heights. One suppressed white pine formed no visible rings at ground level in 28 of the more recent of its 122 years.

* Westveld, Marinus.
1941. YIELD TABLES FOR CUT-OVER SPRUCE-FIR STANDS IN THE NORTHEAST. Northeast. Forest. Expt. Sta. Occas. Paper 12. 18 pp. New Haven.

The application of yield tables to cut-over mixed spruce-hardwood stands. The author discusses the factors influencing growth, the method used in the study, its application for predicting yield, and the expected accuracy.

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1945. DIAMETER GROWTH AS A MEASURE OF TREE VIGOR.
Northeast. Forest Expt. Sta. 6 pp. Philadelphia.

Tree vigor is an important factor in resistance of spruce-fir stands to budworm attack. In place of tree-vigor classes based on external features, the author recommends vigor classes based on diameter growth. Through study of increment cores, the author developed such vigor classes based on diameter growth, for balsam fir and red spruce.

# UTILIZATION

## LOGGING METHODS AND EQUIPMENT

Anonymous.
1942. HOW TO CUT WOOD WITH LESS LABOR.
Conn. Forest and Park Assoc. Pub. 43. 24 pp., illus.

A pamphlet about utilizing cull timber and forest thinnings as a source of wartime emergency fuel. Methods of harvesting cordwood are described: tools and equipment (including power saws and splitters), labor saving methods, and crew organization and operation.

Archer, Donald H.
1947. KEEPING A CHAIN SAW BUSY.
Conn. Woodlands 12: 49-50.

Studies of logging crews operating 3-foot chain saws in Connecticut indicate that a 5-man crew is most efficient for logging white pine. Three men serve the saw in felling and bucking, while the other two cut off limbs.

* Behre, C. Edward, and Reineke, L. H.
1934. A PORTABLE GASOLINE-DRIVEN SAW FOR FELLING AND BUCKING. Jour. Forestry 32: 749-751, illus.

The Wolf saw, developed in Germany was one of the first chain saws put on the market in this country. Time studies were made of its cutting speed, which averaged about 1 minute per square foot for bucking and 2 minutes per square foot for felling.

Larson, E. vH.
1948. LOGGING EQUIPMENT DEMONSTRATED TO INTERESTED WOODS OPERATORS. Canada Lumberman 68 (19): 50-51, 84-85, illus.

Account of a demonstration of logging equipment near Cooperstown, N. Y., in September 1948, sponsored jointly by the Northeastern Forest Experiment Station and the New York Section, Society of American Foresters.

* Simmons, Fred C.
1945. METHODS OF LOADING LUMBER AT THE REAR OF SMALL SAWMILLS. Northeast. Forest Expt. Sta. Forest Prod. Note 2. 6 pp., illus. Philadelphia.

Inexpensive devices designed for shifting complete loads onto trucks or buggies with a minimum of manpower and handling are described and illustrated. Intended especially for the small sawmill, these devices can be made of materials readily available at any mill.

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1945. METHODS OF LOADING LUMBER AT THE REAR OF SMALL SAWMILLS. Canada Lumberman 65 (23): 39-40, 80.

See above. Also in South. Lumberman 174 (2189): 78-80, illus., 1947.

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1946. RECENT DEVELOPMENTS IN LOGGING IN THE NORTHEAST. Northeast. Forest Expt. Sta. Forest Prod. Paper 7. 12 pp., illus. Philadelphia.

Suggests improvements in logging methods and operational efficiency through use of modern mechanical devices. Recommends better living conditions for woods crews and better utilization of wood products. (Based on a paper read before the Maine Hardwood Manufacturers Association in May 1945).

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1946-47. NORTHEASTERN LOGGERS' HANDBOOK. (Prelim. rev. ed.) Northeast. Forest Expt. Sta. 250 pp., illus. Philadelphia.

The Northeastern Loggers' Handbook was published in preliminary review form during 1946 and 1947, and is now (1950) being prepared for publication by the U. S. Department of Agriculture. In it, the author describes both old and new

methods and equipment for the various logging operations. Although intended primarily for loggers in the Northeast, it is applicable to many other regions. The review form of the handbook was issued in sections, as follows:

Sect. 1 - How to choose and use your axe. 10 pp., illus.
* Sect. 2 - How to choose, use and sharpen a crosscut saw. 14 pp., illus.
* Sect. 3 - How to select and take care of your bow saw. 10 pp., illus.
* Sect. 4 - Wedges and their use in logging; splitting wood. 7 pp., illus.
* Sect. 5 - Peavies, cant hooks and pulp hooks. 5 pp., illus.
* Sect. 6 - Tools for peeling wood. 6 pp., illus.
* Sect. 7 - Some pointers on power saws for logging. 14 pp., illus.
* Sect. 8 - Pointers on felling trees. 14 pp., illus.
Sect. 9 - Limbing and bucking the tree. 15 pp., illus.
* Sect. 10 - Ground skidding with horses. 17 pp., illus.
Sect. 11 - Skidding with tractors. 20 pp., illus.
Sect. 12 - Wire rope and accessories. 16 pp., illus.
* Sect. 13 - Cable skidding. 10 pp., illus.
* Sect. 14 - Loading. 24 pp., illus.
* Sect. 15 - Winter hauling. 15 pp., illus.
* Sect. 16 - Logging trucks. 12 pp., illus.
* Sect. 17 - All-weather roads. 22 pp., illus.
* Sect. 18 - Glossary of terms. 20 pp.

The following articles were based on sections of the Loggers' Handbook.

Simmons, Fred C.

1946. SOME POINTERS ON POWER SAWS FOR LOGGING. Wood 1 (1): 18-19.

1946. HOW TO CHOOSE AND SHARPEN A CROSSCUT SAW. South. Lumberman 173 (2169): 68-69.

1946. SKIDDING WITH TRACTORS. South. Lumberman 173 (2173): 72-82.

1946. LIMBING AND BUCKING THE TREE. South. Lumberman 173 (2175): 68-74.

1946. HOW TO SELECT AND TAKE CARE OF YOUR BOW SAW. South. Lumberman 173 (2177): 278-284.

1947. LOG LOADING. South. Lumberman 174 (2183): 73-79, illus.

1947. SOME POINTERS ON POWER SAWS FOR LOGGING. South. Lumberman 174 (2185): 84-90.

1947. CABLE LOGGING.
South. Lumberman 174 (2187): 84-90, illus.

1947. LOGGING TRUCKS.
South. Lumberman 175 (2199): 86-90.

1947. CONSTRUCTION OF ALL-WEATHER ROADS.
South. Lumberman 175 (2201): 282-292, illus.

1947. MORE LOADING TIPS TO SPEED HANDLING.
Wood 2 (3): 26-48, illus.

1947. POINTERS ON TREE FELLING.
Canada Lumberman 67 (21): 52-54, 92-93, illus.

1947. GOOD LOGGING PRACTICE. 1. HOW TO CHOOSE AND USE YOUR AXE. Timber of Canada 8 (3): 30-33, 76, 79-80, illus.

1947. GOOD LOGGING PRACTICE. 2. CANT HOOKS, PEAVIES, AND PULP HOOKS. Timber of Canada 8 (4): 38-39, 58, illus.

1948. SELECTION AND USE OF WIRE ROPE AND ACCESSORIES.
South. Lumberman 176 (2207) 86, 88, 90, 92, illus.

1948. GOOD LOGGING PRACTICE. 3. HOW TO CHOOSE, USE, AND SHARPEN A CROSSCUT SAW. Timber of Canada 8 (5): 30-33, 78, 80-81, illus.

1948. GOOD LOGGING PRACTICE. 4. HOW TO CARE FOR YOUR BOW SAW. Timber of Canada 8 (6): 40-41, 81-82, 85-86, 88, illus.

1948. GOOD LOGGING PRACTICE. 5. WEDGES AND THEIR USE IN LOGGING. Timber of Canada 8 (7): 30-31, 84, illus.

1948. GOOD LOGGING PRACTICE 6. TOOLS FOR PEELING WOOD. Timber of Canada 8 (8): 32-33, 75-76, illus.

1948. GOOD LOGGING PRACTICE. 7. SOME POINTERS ON POWER SAWS FOR LOGGING. Timber of Canada 8 (9): 40-43, 102-107, illus.

1948. GOOD LOGGING PRACTICE. 8. POINTERS ON FELLING TREES. Timber of Canada 8 (10): 40-43, 74, illus.

1948. GOOD LOGGING PRACTICE. 9. LIMBING AND BUCKING THE TREE. Timber of Canada 8 (11): 40-43, 78, 81, illus.

1948. GOOD LOGGING PRACTICE. 10. GROUND SKIDDING WITH HORSES. Timber of Canada 8 (12): 38-41, 58, 74-76, illus.

1948. SKIDDING WITH TRACTORS. No. 11 IN A SERIES ON GOOD LOGGING PRACTICE. Timber of Canada 9 (2): 38-41, 92, 94, illus.

1948. SELECTION AND USE OF WIRE ROPE. No. 12 IN A SERIES ON GOOD LOGGING PRACTICE. Timber of Canada 9 (3): 39-43, illus.

1948. CABLE LOGGING. No. 13 IN A SERIES ON GOOD LOGGING PRACTICE. Timber of Canada 9 (4): 41-43, illus.

1949. LOADING. No. 14 IN A SERIES ON GOOD LOGGING PRACTICE. Timber of Canada 9 (5): 37-40, 74-77, illus.

1949. WINTER HAULING. No. 15 IN A SERIES ON GOOD LOGGING PRACTICES. Timber of Canada 9 (6): 42-46, illus.

* Simmons, Fred C.

1947. MECHANIZING FOREST OPERATIONS. Jour. Forestry 45: 345-349, illus.

Mechanization allows more intensive forest management and lowers the cost of the various operations in logging and hauling. The author describes some of the latest developments and what they mean to forest management.

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1947. MECHANIZING FOREST OPERATIONS. Timber of Canada 8 (3): 26-27, illus.

See above.

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1947. MECHANIZED LOGGING IN THE NORTHEAST. Wood 2 (2): 22-24, illus.

Because of difficulties in procuring men to work in the woods, loggers are turning to mechanical equipment for the solution of their production problems. The author describes advantages and problems in the use of mechanical equipment for logging. He advocates integrated logging as a means of making the best use of forest products. (Based on a paper read before the Appalachian Hardwood Manufacturers Association at Cincinnati in January 1947.)

Simmons, Fred C.

1947. MECHANIZED LOGGING IN THE NORTHEAST. Lumber Camp News 9 (11): 1-6.

See above.

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1948. MECHANIZED LOGGING. Northeast. Wood Util. Council Bul. 21: 24-28.

Despite persistance of old-fashioned lumbering methods, loggers in southern New England are adopting mechanized methods that make possible a high rate of production in a time of high labor costs. Power saws for cutting timber, slasher saws, crawler tractors, loading devices, and logging trucks are being improved constantly; and numerous other devices have been developed for use in harvesting wood products. (Based on a paper read before Southern New England Lumber Products Conference at Storrs, Conn., October 1947.)

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1948. CHOOSING METHODS AND EQUIPMENT FOR LOGGING. Northeast. Forest Expt. Sta. Paper 18. 19 pp., illus. Upper Darby.

A discussion of factors to be considered in planning a logging operation, including the character of the timber stand, the lay of the land, the ownership pattern, wishes of the landowner, the availability and type of labor, and the equipment on hand. Accessibility, comparative advantages and disadvantages of hauling and skidding, loading, and the keeping of cost records are also discussed.

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1948. CHOOSING METHODS AND EQUIPMENT FOR LOGGING. South. Lumberman 177 (2219): 84, 86, 88.

See above.

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1948. FACTORS AFFECTING SELECTION OF LOGGING METHODS AND EQUIPMENT. Canada Lumberman 68 (21): 38-41, 95-96, illus.

See above.

* Simmons, Fred C.
1949. RECRUITING AND TRAINING LABOR FOR WOODS WORK. Northeast. Forest Expt. Sta. Paper 24. 16 pp., illus. Upper Darby.

Logging is a dangerous occupation and operators have difficulty in getting good workers. Modern methods and equipment will help to attract labor; good supervision and good training will help to make the work safer. Methods for training woods workers are outlined.

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1949. SINCE THE DAYS OF LEIF ERICSON. U. S. Dept. Agr. Yearbook 1949: 687-694, illus.

Logging was probably the first commercial activity of white men in the New World. The development of logging from the days of the Norse explorers to present-day mechanized and integrated operations is described. The author says logging is now safer, easier work than in the days of ax and muscle; and new logging communities provide the logger with normal home life and good working conditions.

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1949. MECHANIZED LOGGING. Vt. Bur. Indus. Res. Rpt. of 8th Vt. Wood Prod. Conf. (1948): 22-25, illus.

Woods work must be made safer and easier and more productive if lumbering is to attract and hold the labor it needs. The new mechanical devices--and the methods that go with them--are helping loggers to do this. The author describes briefly some of the new developments in saws, tractors, loading devices, packaging, splitters, and trucks.

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1949. NORTHEASTERN LOGGING PRACTICES. In Harvesting Timber Crops, by A. E. Wackerman. (pp. 367-380) 437 pp., illus. New York.

Discussion of the forest stands, labor, felling and bucking, bunching and skidding, loading, transportation, organization of operations, and nature of cutting for each of three subregions: Northern New England and New York, southern New England and the eastern part of the Middle Atlantic States, and the Appalachian Mountain region.

Simmons, Fred C.

1949. HARVESTING THE FOREST CROP IN THE NORTHEAST AND THE LAKE STATES. In Improvements In Logging Techniques In The United States, by George L. Drake, Fred C. Simmons, M. H. Collet, and E. E. Matson. (pp. 5-14, illus.) United Nations Sci. Conf. Lake Success, N. Y.

During and since World War II changes in logging equipment and techniques have been rapid and spectacular. Scarcity of old-time woodsmen and aversion of young men to old-fashioned logging methods spurred these changes. A number of the new machines and methods are described and illustrated.

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1949. HARVESTING THE FOREST CROP IN THE NORTHEAST AND LAKE STATES. The Lumberman 76 (10): 66-68.

See above.

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1949. HARVESTING THE FOREST CROP IN NORTHEAST AND LAKE STATES. Canada Lumberman 69 (12): 63.

See above.

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1949. NEW DEVELOPMENTS IN HARVESTING SAWLOGS. Forest Prod. Res. Soc. Preprint of 1949 Proc. 10 pp., illus. Madison, Wis.

Much that is new has developed in equipment and methods for harvesting sawlogs in the war and postwar years. The author describes some of these new developments and discusses some of the problems experienced in adopting them.

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1949. LOGGING FOR PROFIT. Wood 4 (5): 26, 46-47, illus.

Mechanical equipment, scaled to proper power and size for Northeastern loggers, is giving Eastern operators a better chance for profits. (Based on a paper presented before the Forest Products Research Society at Grand Rapids, Michigan, May 2-4, 1949.)

Simmons, Fred C.
1949. LOGGING FARM FOREST CROPS IN THE NORTHEAST. U. S. Dept. Agr. Farmers' Bul. 2008. 57 pp., illus.

Logging methods and equipment for use by farmers in the Northeast. Describes hand tools, farm equipment and special equipment used in logging, and lay-out of the logging job. Methods and equipment for felling, limbing, bucking, skidding, loading, and hauling farm forest crops are discussed in detail.

* Trimble, George R., Jr.
1942. LOGGING DAMAGE IN PARTIAL CUTTING OF SPRUCE-FIR STANDS. Northeast. Forest Expt. Sta. Tech. Note 51. 2 pp. New Haven.

Data on logging damage were collected on 32 plots partially cut during the peeling season in New Hampshire. Horse-skidding was used. The amount of serious damage from this partial cutting operation was small. By increasing residual volume, forest managers can make up for expected losses due to logging damage.

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1943. PORTABLE POWER SAWS CAN SPEED UP CORDWOOD PRODUCTION. Allegheny Forest Expt. Sta. Tech. Note 38. 2 pp. Philadelphia.

A portable power saw developed for cutting pine pulpwood in the South showed possible savings of 21 percent in the cost of producing cordwood in Connecticut. The saw tested had a 28-inch circular blade driven by an air-cooled gasoline motor and was mounted on a pair of bicycle wheels, pushcart fashion.

Westveld, M.
1926. LOGGING DAMAGE TO ADVANCE SPRUCE AND FIR REPRODUCTION. Jour. Forestry 24: 579-582.

Presents data from a series of cutting plots in New Hampshire, showing that logging causes serious damage to spruce reproduction. Heaviest losses occur in the 2- to 5-foot height classes, a height class capable of competing successfully with incoming brush and fast-growing weed trees and hardwoods.

# LOGGING COSTS

* Archer, D. H.
1948. LABOR REQUIREMENTS FOR YARDING AND HAULING PULPWOOD. Northeast. Forest Expt. Sta. Paper 13. 5 pp., illus. Philadelphia.

A report on an efficient pulpwood operation in Connecticut. Two experienced French-Canadian pulpwood cutters yarded and loaded 1,000 cords of aspen pulpwood, using a 15-hp. crawler tractor, a 1½-ton truck, 2-cord drays with pivoted front bobs, and pulp hooks. They moved the pulpwood from the woods to a railroad siding and loaded the wood into boxcars at an average of 93 man-minutes per cord.

* Belotelkin, K. T., Reineke, L. H., and Westveld, M.
1941. SKIDDING IN SELECTIVE PULPWOOD LOGGING. Northeast. Forest Expt. Sta. Tech. Note 40. 3 pp. New Haven.

Analysis of logging costs, with particular emphasis on skidding, on a 95-acre tract of spruce and fir pulpwood at Gale River Experimental Forest in 1937. Indicates (1) that in logging with horses, costs in partial cuttings that remove 10 to 60 percent of the stand do not exceed clear-cutting costs; and (2) that with further experience selective cutting may be cheaper than clear-cutting.

* ---------- Reineke, L. H., and Westveld, M.
1942. SPRUCE-FIR SELECTIVE LOGGING COSTS. Jour. Forestry 40: 326-336, illus.

See above.

* Bratton, Allen W.
1946. HARDWOODS--THE BIGGER, THE BETTER: HEMLOCKS--JUST GET BIGGER. Northeast. Forest Expt. Sta. Forest Economics Note 2. 3 pp., illus. Philadelphia.

Hardwoods and hemlock are compared in proportion of quality lumber produced by varying log sizes. The author points out that hardwoods can frequently be left in the woods profitably, even when growth rate has slowed, whereas hemlock may not.

* Bratton, Allen W.
1948. HARDWOOD LOG GRADING AND LUMBER VALUE.
Northeast. Forest Expt. Sta. Paper 14. 6 pp., illus. Philadelphia.

Study of the use of log grades (developed by the U. S. Forest Service's Forest Products Laboratory) by the Otsego Forest Products Cooperative Association (Cooperstown, N. Y.) demonstrated that log grades not only give the sawmill operator a good yardstick for estimating the value of the logs he buys; they also make possible fair prices to the woodland owner and logger; and they create an incentive for producing better logs.

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1948. HARDWOOD LOG GRADING AND LUMBER VALUE.
South. Lumberman 177 (2217): 52-54.

See above.

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1948. HARDWOOD LOG GRADING.
Wood 3 (8): 18-19, illus.

See above.

* Carpenter, R. D.
1941. LOG PURCHASING UNITS IN NORTHEASTERN NEW YORK STATE.
Northeast. Forest Expt. Sta. Tech. Note 44. 6 pp., illus. New Haven.

The seven measures of log volume used by log purchasers in four northeastern counties of New York State were analyzed to see how woodland owners fared under the various purchase systems. The author suggests a single unit be adopted as standard.

* Cunningham, F. E., and Ferguson, R. H.
1946. COST OF PRODUCING HARDWOOD TIES IN CONNECTICUT.
Jour. Forestry 44: 668-672, illus.

Report on a time study of logging and milling operations on a typical Connecticut tie job. For each phase of the job, the man-hours per thousand board feet (log scale) decrease as tree diameters increase, up to 21 or 22 inches d.b.h. Suggestions are offered as a means of improving the over-all efficiency of such an operation.

Doverspike, George E., and Rettie, James C.
1949. LUMBER VALUES FROM GRADED LOGS--BLACK CHERRY AND OAK--AT A WESTERN PENNSYLVANIA SAWMILL. Northeast. Forest Expt. Sta. 5 pp. Upper Darby.

A practical study of the use of log grades developed by the Forest Products Laboratory and the Forest Service's log grade committee showed that lumber value is correlated closely with log grade. General need for use of log grades is pointed out.

* Ferree, Miles J.
1946. RATE OF MINE PROP PRODUCTION INCREASES WITH SIZE OF TREES. Northeast. Forest Expt. Sta. Forest Economics Note 1. 2 pp., illus. Philadelphia.

Compares time required to produce mine props from trees of various diameters. Shows results of a time study on all operations from notching and felling to loading on trucks (for trees ranging from 2 to 16 inches d.b.h.).

* Hough, A. F.
1941. PULPWOOD PIECE CUTTERS PROFIT BY SELECTIVE CUTTING. Allegheny Forest Expt. Sta. Tech. Note 31. 1 p. Philadelphia.

Results of a time study on the cost of producing pulpwood by clear-cutting versus selective cutting. Cutting small trees is wasteful to the wood cutter, the pulp company, and the forest.

* Jensen, Victor S., Behre, C. Edward, and Benson, A. O.
1940. COST OF PRODUCING WHITE PINE LUMBER IN NEW ENGLAND. U. S. Dept. Agr. Cir. 557. 40 pp., illus.

Production costs per thousand board feet declines rapidly with increase of tree size, leveling off at 20 inches in diameter. Partial cutting does not increase operating costs in accessible stands. Value of graded lumber from pruned logs is 50 percent greater than from unpruned logs. Square-edged lumber reduces mill scale about 21 percent, but increases sale value about 28 percent. Graded-lumber values exceed mill-run prices.

Jensen, Victor S.
1940. COST OF PRODUCING PULPWOOD ON FARM WOODLANDS OF THE UPPER CONNECTICUT RIVER VALLEY. Northeast. Forest Expt. Sta. Occas. Paper 9. 30 pp., illus. New Haven.

Tree size affects cost of producing peeled pulpwood from spruce and fir more than any other factor. Twice as much time is required per cord for 4-inch as for 13-inch trees. One man can produce 30 percent more pulpwood alone than when working with a partner. A 3-man crew is least effective. Spruce requires more labor than fir. Skidding should not ordinarily exceed 600 feet. Production time is higher in selective cutting, but this is more than offset if average diameter is only an inch greater than would be obtained in clear-cutting.

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1941. PULPWOOD PRODUCTION COSTS ON SMALL OPERATIONS IN THE UPPER CONNECTICUT RIVER VALLEY. Jour. Forestry 39: 991-993, illus.

See above.

* McLintock, T. F., and Westveld, M.
1946. SOME FINANCIAL ASPECTS OF REMOVAL OF OVERMATURE BALSAM FIR AS A BUDWORM CONTROL MEASURE. Northeast. Forest Expt. Sta. Forest Management Paper 1. 8 pp. Philadelphia.

The costs of removing overmature balsam fir trees were studied, as a means of reducing the hazard of spruce budworm attack. Three pulpwood crews of five men each cut marked trees on a 20-acre area in Maine. To show how much cull balsam firs of various sizes may have, and still be worth logging for what solid wood they contain, the authors have correlated the percentage of cull with the size of sound trees that have equivalent pulpwood value.

* ---------- and Westveld, M.
1947. SOME FINANCIAL ASPECTS OF REMOVAL OF OVERMATURE BALSAM FIR AS A BUDWORM CONTROL MEASURE. Canad. Pulp and Paper Assoc. Woodlands Sect. Index 942 (F-3). 4 pp.

See above.

Carter, Roy M.
1948. THE COSTS OF POOR KILN DRYING.
Northeast. Wood Util. Council Bul. 23: 5-12.

Wood-working industries lose about 11 percent of their lumber because of end checks, surface checks, honeycomb, warping and other defects that develop during kiln-drying. (One plant drying white pine found that more than 50 percent of the boards split during planing, a loss of $1,500 per kiln load.) Almost all these losses could be eliminated by better kilns and better kiln operation.

Cook, David B., and Sims, Ivan H.
1949. BEECH UTILIZATION AND MANAGEMENT PROBLEMS AND POSSIBILITIES. Soc. Amer. Foresters Proc. 1948: 86-90.

American beech (Fagus grandifolia), one of the most widely distributed native hardwoods in the United States, is a "problem child". Markets for it are poor. Loggers want to leave it in the woods; foresters want to get it out. The authors describe the silvical characteristics of the species, the many uses for the wood, and how the seasoning problem--the big difficulty--can be solved.

---------- and Sims, Ivan H.
1949. BEECH UTILIZATION AND MANAGEMENT PROBLEMS.
Forestry Chron. 25 (1): 15-20.

See above.

Peck, Edward C., Baker, Gregory, and Carter, Roy M.
1948. CHEMICAL TREATMENT OF THICK BEECH STOCK.
U. S. Forest Serv. Forest Prod. Lab. Rpt. R1708.
7 pp., illus. Madison, Wis.

Because thick beech stock generally splits and checks badly during air seasoning, beech is often difficult to use in the manufacture of products such as bowls for shaving soap. A treatment with buffered sodium chloride--common salt plus some corrosion-inhibiting chemicals--makes it possible to season beech effectively and with relatively little loss. The best results were obtained by spreading a layer of the dry chemical over each layer of the turning squares as they were piled for seasoning.

Peck, Edward C., Baker, Gregory, and Carter, Roy M.
1948. CHEMICAL TREATMENT AND SEASONING OF THICK BEECH STOCK. Wood Working Digest 50 (8): 104-108, illus.

See above.

---------- Baker, Gregory, and Carter, Roy M.
1948. CHEMICAL TREATMENT AND SEASONING OF THICK BEECH STOCK. Wood Prod. 53 (7): 16-18, illus.

See above.

---------- Baker, Gregory, and Carter, Roy M.
1948. CHEMICAL TREATMENT AND SEASONING OF THICK BEECH STOCK. South. Lumberman 177 (2220): 58, 60.

See above.

---------- Baker, Gregory, and Carter, Roy M.
1948. TURNING BEECH TO BOWL STOCK WITH CHEMICALS. Wood 3 (6): 22-23, illus.

See above.

Simmons, Fred C.
1949. THE KEYSTONE KILN DRYING ASSOCIATION. Forest Leaves 34 (1): 13-14.

An account of how a group of Pennsylvania wood-users have organized to pool their knowledge and experience for attacking one of the industry's big postwar problems--how to get well-seasoned lumber and other wood products.

## PROCESSING

* Carter, Roy M.
1947. FRONT LINE DEVELOPMENTS IN WOOD TREATMENT RESEARCH. Northeast. Forest Expt. Sta. 10 pp. Philadelphia.

Wood-treatment research has three main lines of endeavor: (1) wood preservation, (2) dimensional stabilization, and (3) fire-proofing. New preservatives, the preservation of plywood and laminated wood, the gluing of preservative-treated lumber are briefly discussed. Acetylated wood, Impreg, the urea-resin treatment, Compreg, Staypak, and Staybwood are

described. Other developments include commercial impregnation substances, fire-retarding paints, wood-surface treatments such as water repellents, and wood sealers. A list of recent Forest Products Laboratory literature on all of these subjects is offered.

Carter, Roy M.
1947. FRONT LINE DEVELOPMENTS IN WOOD TREATMENT RESEARCH. Wood. Util. Council Bul. 18: 5-15.

See above.

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1947. TRENDS AND PROBLEMS OF THE WOOD TURNING INDUSTRY IN THE NORTHEAST. Northeast. Forest Expt. Sta. Note 2. 6 pp. Philadelphia.

Wood-turning plants, which consume more hardwood than any other industry in the Northeast, have increasing problems in obtaining the quantity and quality of wood needed, and in competing with other materials such as plastics. Problems of seasoning birch and beech, of machining, waste, and labor are also discussed. Several practical suggestions for meeting these problems are offered.

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1947. TRENDS AND PROBLEMS OF THE WOOD TURNING INDUSTRY IN THE NORTHEAST. Wood Working Digest 49 (6): 67-76.

See above.

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1947. TRENDS AND PROBLEMS OF THE WOOD TURNING INDUSTRY IN THE NORTHEAST. Vt. Bur. Indus. Res. Rpt. of 6th Vt. Wood Prod. Conf. (1946): 4-10.

See above.

---------- and Rettie, James C.
1948. HIGHLIGHTS OF WOOD LAMINATING. Northeast. Wood Util. Council Bul. 22: 5-20.

Development of new waterproof synthetic-resin glues has stimulated the use of laminated wood materials. The authors review the merits of lamination, glues, preparation of laminating stock (machining and moisture requirements) and gluing procedures. Laminating is a business that requires

careful preparation and control, and special knowledge of timber physics. It is an expensive process.

Carter, Roy M., and Rettie, J. C.
1948. WOOD LAMINATING HIGHLIGHTS.
South. Lumberman 177 (2216): 69-70, 72.

See above.

---------- and Rettie, J. C.
1949. MACHINING AND PREPARATION OF THE LAMINATING STOCK.
Veneers and Plywood 43 (3): 34, 36-37.

See above.

* Jensen, V. S.
1939. EDGING WHITE PINE LUMBER IN NEW ENGLAND.
Northeast. Forest Expt. Sta. Tech. Note 26. 2 pp.
New Haven.

In New England much white pine is used in round-edge boards. Because wooden-box plants already have large stocks of this material, mill operators are advised to edge their white pine lumber to find markets for the huge amount of hurricane-felled trees being salvaged. Edging might improve both the market and the grades of white pine lumber. Cost studies indicate that a small or medium-sized mill can install a new edger economically.

* Simmons, Fred C.
1949. SAWMILL TECHNIQUES.
United Nations Sci. Conf. on Conserv. and Util. of Resources. 33 pp., illus. Lake Success.

A discussion of the different kinds of sawmills and their capabilities and limitations. Up-and-down saws, circular saws, band saws, bolters, resaws, gangsaws, and accessory saws (edgers, trimmers) are described. Special types such as trailer mounted saws are also described. Mill set-up and operation are discussed briefly.

* ----------
1949. WHAT'S NEW IN SAWMILLING?
South. Lumberman 179 (2242): 64-74, illus.

New developments in sawmilling methods and machinery have come thick and fast since the end of the war. The industry is seething with new ideas. The author describes some of

the new developments: log washers and debarkers, new kinds of sawmills and carriages, bolters, horizontal bandsaws with merry-go-round infeed, various kinds of gang saws, mobile sawmills, and other kinds of sawmill equipment.

Simmons, Fred C.
1949. SAWMILL TRENDS. (PART 1.)
Wood 4 (8): 27-28, 45, illus.

See above.

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1949. SAWMILL TRENDS. (PART 2.)
Wood 4 (9): 26, 48-50, illus.

See above.

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1949. WHAT'S NEW IN SAWMILLING. (PART 1.)
Canada Lumberman 69 (9): 81-82, 153-154, illus.

See above.

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1949. WHAT'S NEW IN SAWMILLING. (PART 2.)
Canada Lumberman 69 (10): 47-48, 72, illus.

See above.

## FUEL WOOD

Anonymous.
1942. HOW TO BURN WOOD: NEW METHODS AND NEW MARKETS.
Conn. Forest and Park Assoc. Pub. 33d. 24 pp., illus.

A pamphlet about the use of wood as a wartime emergency fuel, prepared in cooperation with the Allegheny Forest Experiment Station. Fuel values of different species are compared. The slow-combustion method, the char-wood heater, wood furnaces, ways of converting coal furnaces to wood use, sawdust burners, and fireplaces are described; also, the uses of hogged wood, producer gas, and charcoal. Cordwood standards are outlined.

* Bratton, Allen W.
1940. THE TESTING OF CHAR-WOOD HEATERS IN CONNECTICUT. Northeast. Forest Expt. Sta. Occas. Paper 10. 10 pp., illus. New Haven.

Char-wood heaters were tested under field conditions to determine their efficiency, safety, and operating cost. Indications were that they gave more uniform heating and used less wood than other types of wood-burning stoves in use. Fires burned an average of 9 hours (10 hours when banked) between charges. Fire hazard was less than with the usual wood-burning stoves.

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1941. THE PRODUCTION OF HOGGED WOOD FROM CONNECTICUT HARDWOODS. Northeast. Forest Expt. Sta. Tech. Note 41. 3 pp. New Haven.

The results of the experimental "hogging" of mixed Connecticut hardwoods with a commercial chipping machine. Approximately one unit (200 cubic feet) of hogged wood was produced per standard cord (75 cubic feet net). Costs of hogging 8- and 12-foot lengths were lower than for 4-foot lengths.

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1942. FUELWOOD SEASONING TESTS. Northeast. Forest Expt. Sta. Tech. Note 50. 2 pp. New Haven.

The speed of seasoning green oak cordwood is shown to be roughly proportional to the surface area exposed. Splitting of larger sticks increases the rate of drying. Length has little effect on rate of drying.

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1944. DOMESTIC SAWDUST BURNERS. Conn. Woodlands 9 (1): 13-14.

The writer's experience in heating a dwelling with a sawdust burner installed in a hot-air furnace. The burner, operated through a rather severe New York winter, gave satisfactory results with a large saving over the cost of burning oil the previous winter.

Bratton, Allen W.
1944. THE USE OF WOOD FOR FUEL.
Jour. Forestry 42: 663-667.

Summarizes the advantages and disadvantages of wood as a fuel, and describes a number of types of wood-burning heaters (including slow-combustion stoves for chunk wood, sawdust burners, and Dutch ovens for industrial and institutional use) and the production and use of wood gas and charcoal.

Fenton, Richard.
1949. FUTURE PROSPECTS FOR FUELWOOD CONSUMPTION.
Conn. Woodlands 14 (5): 74-75.

Use of wood as a fuel should be promoted because it would create a use for the large volume of low-quality hardwoods present in most northeastern woodlands; also, fuel-wood cutting could be used as a means of improving woodlands for timber production. Two developments that may overcome some of the problems of using wood for fuel are mentioned: the downdraft wood-burning furnace, and the use of chipped wood.

* Rettie, James C.
1945. PUTTING FUEL SAWDUST IN THE CUSTOMER'S BASEMENT.
Northeast. Forest Expt. Sta. Forest Prod. Note 1. 2 pp., illus. Philadelphia.

Plans and specifications for a simple wheel-barrow for use in lieu of the usual coal chute for transporting sawdust or "hogged" wood fuel from truck to basement.

* Trimble, G. R., Jr., and Bratton, Allen W.
1943. SUMMER SEASONED FUEL WOOD BEST.
Allegheny Forest Expt. Sta. Tech. Note 40. 2 pp., illus. Philadelphia.

Short description of tests made over a period of 12 months to determine when to cut hardwoods in the Northeast to produce well-seasoned fuel wood. To insure a supply of well-seasoned fuel wood for winter use, the supply should be cut in June or July, piled outdoors until the middle of October, and then moved into a dry, indoor storage place.

# DERIVED PRODUCTS

Behre, C. Edward.
1938. CHEMURGIC POSSIBILITIES IN NEW ENGLAND FOREST PRODUCTS. Northeast. Forest Expt. Sta. 19 pp. New Haven.

Wood is a raw material from which a great variety of materials can be produced chemically. The author points out some of the possibilities such as pulp and paper, cellulose and related products such as rayon, pulping liquor, plastics, alcohol, charcoal, and other products of wood distillation. He warns that New England's problem is not only to develop new wood products but--even more important--to improve the production and marketing of simple wood products and to protect the forest resource.

Carter, Roy M.
1949. BYPRODUCTS FROM MILL WASTE.
Vt. Bur. Indus. Res. Rpt. of 8th Vt. Wood Prod. Conf. (1948): 7-17.

Discussion of wood waste and the need for reducing it. Possible uses for sawdust and shavings, slabs, edgings, trimmings, and bark are outlined. The specific uses possible are many and varied: wood flour, insulation, plastics, wood-sugar molasses, sawdust-cement concrete, soil supplement, fuel for gasogen power units, fiber products, chemical products, and many others.

Fenton, Richard H.
1948. MANUFACTURE AND UTILIZATION OF CHARCOAL.
Conn. Agr. Expt. Sta. Bul. 519: 38-41. New Haven.

Connecticut consumes 15,000 to 20,000 tons of charcoal annually, but the kilns of the State produce less than 2,000 tons. There is an opportunity for increasing production in Connecticut. The author cites costs and return figures to show that charcoal can be produced profitably.

* Olson, A. Richard, and Hicock, Henry W.
1941. A PORTABLE CHARCOAL KILN USING THE CHIMNEY PRINCIPLE. Conn. Agr. Expt. Sta. Bul. 448: 487-512, illus.

Description of the construction and operation of three experimental kilns patterned after a type of kiln

devised by Swedish engineers. In this type of kiln, the "smoke" is led away through a single outlet, and all the air inlets are localized in one part of the kiln. It was found that, except for the firing period, practically no attention was required during the coaling of the charge.

* Reineke, L. H., and Bratton, A. W.
1940. PRODUCER GAS AS AN OUTLET FOR LOW-GRADE HARDWOODS. Northeast. Forest Expt. Sta. Tech. Note 36. 2 pp. New Haven.

Summarizes the results of preliminary investigation of the possibility of using wood-producer gas to heat a State institution in Connecticut. The conclusion was that for an installation such as this, where there were definite peak loads in demand, wood gas would be more expensive than coal, but that for a user whose demand was more steady, such as a bakery, wood gas would be cheaper.

## MINOR PRODUCTS

Mollenhauer, Wm. Jr.,
1942. THERE'S SUGAR IN THE YOUGH.
Forest Leaves 32 (1): 9-10.

The author extols the sugar maple groves found in the Youghiogheny Valley of western Pennsylvania, and the syrup they produce.

Schnur, G. Luther.
1940. CERTIFIED HOLLY.
Forest Leaves 39 (6): 3.

The Maryland State Department of Forestry has started a practice of certifying holly foliage cut for commercial sale. It certifies that the holly is freshly cut and high grade. Certification was originally proposed by garden clubs, in an effort to prevent the wanton destruction of holly trees.

# FOREST ECONOMICS

## GENERAL

* Allegheny Forest Experiment Station.
1940. SURVEY OF FOREST EMPLOYMENT POSSIBILITIES IN THE ANTHRACITE REGION OF PENNSYLVANIA: PURPOSE AND PROCEDURE. Allegheny Forest Expt. Sta. Anthracite Survey Paper 1. 7 pp. Philadelphia.

The Anthracite Region needs secondary industries to absorb idle manpower. Forestry work on 2 million acres of inferior second-growth stands may aid in relieving the situation. Procedures for measuring the anticipated benefits in employment and renewed natural resources are presented.

* Banks, Wayne G., and Rettie, James C.
1949. RESTOCKING CONDITIONS ON THE BURNED-OVER FOREST LANDS OF SOUTHWESTERN MAINE, JUNE 1949. Northeast. Forest Expt. Sta. Paper 30. 9 pp., illus. Upper Darby.

Results of an economic study to determine the extent of natural regeneration on areas burned by forest fires in southwestern Maine in 1947, and to estimate acreage on which some kind of artificial regeneration is needed. High-priority planting is recommended for 34,000 acres. An estimate is made of nursery-stock requirements. (See also NUTTING, RETTIE, and BANKS, 1949, Northeast. Forest Expt. Sta. Paper 23, p.178.)

Behre, C. Edward.
1936. THE PLACE OF FORESTRY IN THE NEW AGRICULTURAL CONSERVATION PROGRAM. Jour. Forestry 34: 674-681.

The new agricultural program (replacing the AAA) and its possible application to farm forestry. Planting of forest trees has already been recognized as a basis for Federal aid. A basis for payments for forest improvement is proposed by the author.

* ---------- and Lockard, C. R.
1937. CENTRALIZED MANAGEMENT AND UTILIZATION ADAPTED TO FARM WOODLANDS IN THE NORTHEAST. Charles Lathrop Pack Forestry Found. and N. Y. State Col. Forestry. 67 pp., illus.

The authors show the need for sustained-yield management, and give examples of what can be accomplished. They describe the Cooperstown (N.Y.) Forest Unit and describe the organization and objectives of the Otsego Forest Products Cooperative Association, and how it is attaining these objectives.

Bevan, Arthur.
1946. THE WORLD TIMBER TRADE AND THE FUTURE. Jour. Forestry 44: 853-855.

Survey of the postwar lumber shortage and future prospects. The shortage stems mostly from those countries that usually export lumber, especially the United States and Russia. Wood from tropical America may help to alleviate the situation, and the critical need for veneer logs may also be partially filled by imports.

Bratton, Allen W.
1949. COOPERATIVES AND SMALL WOODLANDS. U. S. Dept. Agr. Yearbook 1949: 183-190.

Seventy-six cooperatives in 26 States have attempted to solve some or all of the problems of growing, harvesting, processing, marketing, and purchasing forest products. Most of them were small local organizations. The author describes the different kinds of forest cooperatives, and outlines the principles followed by successful cooperatives.

* Doverspike, George E.
1949. PRELIMINARY SURVEY OF MARKETS AND PRICES OF FOREST PRODUCTS IN THE DEL-MAR-VA PENINSULA. Northeast. Forest Expt. Sta. Paper 27. 27 pp., illus. Upper Darby.

Report on methods of marketing forest products in Del-Mar-Va. There is no organized market information for the farmer who wants to sell timber. Marketing methods are haphazard. Prices are usually what the buyer thinks the owner may be willing to take, and they have little kinship with volume. A price-reporting service could be set up for forest products; it would help to reduce the present wide spread of prices and would encourage more reliable methods of arriving at estimates of timber value.

Forbes, R. D.
1941. FORESTS AND JOBS IN THE ANTHRACITE REGION OF PENNSYLVANIA. Jour. Forestry 39: 197-201.

With a drop in production of hard coal from 100 million tons in 1917 to about 50 million tons in 1940, unemployment became a serious problem in the Anthracite Region. In the spring of 1939 Congress appropriated $18,000 for a survey of the possibilities of forest employment in this region. The author outlines the work of the anthracite survey.

* ---------- and Mesavage, Clement.
1943. THE FORESTS OF LUZERNE COUNTY, PENNSYLVANIA, IN RELATION TO EMPLOYMENT AND WELFARE. Allegheny Forest Expt. Sta. Anthracite Survey Paper 5. 21 pp., illus. Philadelphia.

In Luzerne County hard coal mines do not contribute to the local economy the support they once did. The remnant forests of the area, badly deteriorated by past mismanagement and misuse, could be developed to bolster the economy of this area if the drain upon the forests by the mining industry were controlled through local action (supported by State and Federal agencies) and the forest growing stock were built up and maintained.

Ineson, Frank A., and Ferree, Miles J.
1948. THE ANTHRACITE FOREST REGION--A PROBLEM AREA. U. S. Dept. Agr. Misc. Bul. 648. 71 pp., illus.

The Anthracite Region of Pennsylvania, whose economy depends mainly on coal mining, has a chronic unemployment problem that in times of depression becomes acute. The

authors point out that the forests of the region are a misused resource that could be developed not only to take the sting off future hard times, but also to bolster the region's one-sided economy. They estimate that if the forests were built up, managed well, and utilized well, they could make possible the employment of 30,000 persons in woods work and provide an income of about $75,000,000 (1943 basis). This compares with 7,000 persons employed in woods work in 1943, and income of $17,000,000 from the forests.

Jensen, Victor S.
1933. FORESTRY WORK FOR UNEMPLOYMENT RELIEF.
Northeast. Forest Expt. Sta. Occas. Paper 1.
6 pp., illus. New Haven.

The author points out the many possibilities for profitable employment in the forests to relieve the unemployment situation. Activities such as thinnings, cleanings, weedings, pruning, and girdling are suggested. The value of each of these measures is discussed.

* Johnson, Hugh A.; Fellows, Irving F.; Rush, Donald; Lockard, C. R.; and Behre, C. Edward.
1944. WOODLAND OPPORTUNITIES ON DAIRY FARMS IN NEW YORK.
Charles Lathrop Pack Forestry Found. 35 pp., illus. Washington.

A survey of the farm economy of Otsego County, New York, and the opportunities for improving it through integrating farm forestry with other farm enterprises. In this region the economy is based on dairy farming, and the value of the woodland resource has been neglected. The development of the Otsego Forest Products Cooperative Association, of Cooperstown, stimulated the study.

* Lockard, C. R.
1942. VIEW-POINTS ON FARM FORESTRY.
Northeast. Forest Expt. Sta. Tech. Note 52.
4 pp. New Haven.

There is ample information on how to manage farm forests, but somehow it is not used. Among the reasons for this is the fact that few farmers consider their woodlots as integral parts of their business, frequently because their woods are in a poor productive condition due to previous mismanagement. The returns from a well-managed woodlot, however, will compare favorably with those from the farmers' other activities.

Lockard, Charles R.
1942. WOOD AS A FARM CROP.
East. States Co-op. 18 (10): 5-6, illus.

The author compares the value of timber on the stump with the value of oats on the stalk and milk in the cow, and points out that timber is a crop the farmer cannot afford to ignore. He urges that farm woodlands be put under good forest management.

Mesavage, Clement.
1939. FORESTRY AND THE FUTURE OF THE ANTHRACITE REGION.
Forest Leaves 29 (2): 3,13.

The author says that Anthracite Region forests have remained abused or neglected in the midst of a region where the need for diversified wood products, forest recreation, and watershed protection is as great as in any comparable area in the United States. He believes that development of the forest resource will help to rehabilitate the Anthracite Region.

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1940. FORESTRY AND THE PENNSYLVANIA ANTHRACITE COAL REGION.
Forest Leaves 30 (1): 1-2, 13-14. illus.

A condensation of the February 1939 report of the Anthracite Region Rehabilitation Committee to the Allegheny Section, Society of American Foresters. The committee recommends establishment of an Anthracite Region Forest Experiment Station to supply data toward solving the many problems that confront the region.

* Northeastern Forest Experiment Station.
1945. THE FOREST SITUATION IN PIKE AND MONROE COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 7. 31 pp., illus. Philadelphia.

Though nine-tenths of the forest land in Pike County and slightly more in Monroe County bears unmerchantable stands, the future outlook is promising. Forests in these counties are growing more rapidly than they are being cut.

Northeastern Forest Experiment Station.

1945. THE FOREST SITUATION IN DAUPHIN AND LEBANON COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 8. 30 pp., illus. Philadelphia.

Approximately one-third of the total land area of Dauphin and Lebanon Counties is in forest, the bulk of it in the northern section. Extensive logging and repeated fires in the past have reduced the forests in timber size and value until they are of small importance to the economy of the two counties. On the whole, the forests are slowly growing back to merchantability.

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1946. THE FOREST SITUATION IN SCHUYLKILL AND CARBON COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 9. 34 pp., illus. Philadelphia.

A geographic and economic description, mainly statistical, of Schuylkill and Carbon Counties. Although 72 percent of the gross area in these counties is forested, nearly 90 percent of the timber is unmerchantable because of past lumbering practices, demands of the mining industry, and forest fires. Recommendations for attaining productive forests include: (1) more effective fire prevention and suppression, (2) improved forest-management practices, (3) planting to supplement natural regeneration, (4) protection of watersheds, (5) stabilization of mine waste banks and strippings, and (6) increased public ownership.

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1946. THE FOREST SITUATION IN WYOMING AND SULLIVAN COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 10. 29 pp., illus. Philadelphia.

A statistical report on the geographic and economic importance of the Wyoming and Sullivan County area in the Anthracite Forest Region. Past lumbering practices and forest fires have increased the acreage of unmerchantable and low-quality timber. Two corrective measures are proposed (1) active practice of forest-management principles in the sugar maple-beech-yellow birch type, which is most prevalent; and (2) protection from fire. Some spot-planting in the aspen-gray birch-pin cherry type is also suggested.

Northeastern Forest Experiment Station.

1946. THE FOREST SITUATION IN NORTHUMBERLAND, COLUMBIA, AND MONTOUR COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 11. 37 pp., illus. Philadelphia.

In these three counties in the foothill country between the Allegheny Plateau and the Appalachian chain, manufacturing, mining, and farming are the framework of the economy. Only 42 percent of the area is forested, and nowhere is the condition of the forests good. In Northumberland and Montour Counties 91 percent of the forest is unmerchantable. To bring these forests back into production, these measures are proposed: (1) continue work in controlling and preventing fires, (2) stop clear-cutting and improve timber stands, (3) plant waste areas, and (4) increase public ownership.

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1946. THE FOREST SITUATION IN LUZERNE AND LACKAWANNA COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 12. 33 pp., illus. Philadelphia.

Located in the heart of the Anthracite Region, these two counties have the region's forest problem in its most intense form. Forests cover two-thirds of the area, but they are in poor condition: nearly 80 percent of the forest averages less than 230 cubic feet per acre. This is due to clear-cutting for mine timbers. Much of the forest area is potentially productive, and a program of protection, stand improvement, planting, and public ownership is proposed. In addition, a need is seen for educational activities to bring the seriousness of the forest situation to public attention.

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1946. THE FOREST SITUATION IN WAYNE AND SUSQUEHANNA COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 13. 31 pp., illus. Philadelphia.

Dairy farming is the principal occupation in these two counties, and the population is rural and sparse. More than half the forest acreage is in unmerchantable stands, and virtually all the virgin timber has been removed. But in many places the forests have grown back into fairly well stocked second-growth stands, and considerable cleared land is reverting to forest. Selective cutting and some planting are recommended, and educational activities and increased

public ownership are proposed. A forest cooperative might be of value to the economy of this area.

* Nutting, A. D., Rettie, James C., and Banks, Wayne G.
1949. REHABILITATION OF FIRE-DAMAGED FOREST LANDS IN SOUTHWESTERN MAINE. Northeast. Forest Expt. Sta. Paper 23. 22 pp. Upper Darby.

Report on an economic study--in cooperation with the State of Maine--of the forest land burned over in the forest fires of October 1947, and the prospects of rehabilitating these lands. Land ownership and attitudes of landowners toward rehabilitating these lands are considered. An action program is outlined, and three plans for expanding nursery facilities (for planting stock) are presented. (See also NUTTING and McGUIRE, 1948, Northeast. Forest Expt. Sta. Paper 19, p. 94.)

* Rettie, James C.
1945. THE POPULATION AND EMPLOYMENT OUTLOOK FOR THE ANTHRACITE REGION OF PENNSYLVANIA. Northeast. Forest Expt. Sta. Anthracite Survey Paper 6. 25 pp., illus. Philadelphia.

Unemployment in the Anthracite Region before the war was acute, involving more than one-fourth of the labor force. Without a substantial influx of new industries, unemployment may become almost as high after the war as before. Public and private action to expand the anthracite industry and bring in new industries is recommended. Building up the forests and forest industries would be a small but important part of such a program.

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1949. THE TOUGH KNOTS IN NORTHEASTERN TIMBER UTILIZATION CONSIDERED. Commercial Bulletin 91 (4841): 1, 7.

Address at wood utilization conference at University of Maine. Reviews the forest problem in Maine, where cutting for softwood has left hardwood stands in decadent condition. The need is for building up utilization of hardwood by industry. Problems in milling, marketing, and research must be met. A series of studies on beech is cited as one research attack on the problem.

* Rettie, James C., Banks, Wayne G., and Doverspike, George E.
1949. PRELIMINARY SURVEY OF THE MARKETING OF FARM WOODLAND PRODUCTS IN THE NORTHERN NEW ENGLAND STATES. Northeast. Forest Expt. Sta. Paper 25. 28 pp., illus. Upper Darby.

Economic history of the region and present status of marketing and price reporting for farm woodland products. The small forest owner (except in Vermont) has problems in finding outlets for hardwood species. Development of standard specifications for various products and use of standard log grades for hardwood sawlogs would be helpful. Further development of price and market reporting services is also desirable.

* Shirley, Hardy L.
1942. SAFEGUARDING COMMUNITY TIMBER SUPPLIES. Forest Leaves 32 (3): 3, 8-10, illus.

Examples of permanently prosperous communities based on stable wood-using industries are far too rare. The author cites an example of one such community. He shows how local community planning and action could accomplish the same results by regulating the methods of managing forest land.

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1942. LUZERNE COUNTY LOOKS AT HER FORESTS. Forest Leaves 32 (6): 1-2, 11.

Luzerne County depends greatly on coal mining and related industries. In time of depression, other industries are needed to absorb thousands of jobless workers laid off at the mines. The question is: are the forest resources contributing their share to the local welfare? A survey of the region in 1939 indicates that the local economy could be improved by adopting sound forestry practices.

Stoddard, Charles H., Jr.
1937. THE EFFECT OF RECENT ECONOMIC TRENDS AND RESEARCH ON THE FINANCIAL ASPECTS OF FOREST INVESTMENTS. Jour. Forestry 35: 584-586.

In the past, sustained-yield forestry has had to compete for capital with high-grade stocks and bonds yielding comparatively high rates of interest. Because of the supply of capital available for investment, interest rates have fallen from 6 percent to $2\frac{1}{2}$ or $3\frac{1}{2}$ percent. This reduction, together with the fact that the indebtedness of the industry can often be refinanced at lower interest rates, should have a favorable effect on sustained-yield forestry.

# FOREST SURVEY

Girard, James W., and Mesavage, Clement.
1940. FIELD INSTRUCTIONS FOR THE FOREST INVENTORY. Northeast. Forest Expt. Sta. 36 pp. Philadelphia.

A manual describing a method of obtaining field data for the forest inventory of the Anthracite Region. It presents the methods of the survey, the organization of work, field procedures, use of forms, and the desired standards of accuracy. The instructions are for a strip method of survey with a minimum use of aerial photographs.

* Harper, V. L.
1948. FOREST SURVEY IN THE NORTHEAST. Northeast. Forest Expt. Sta. 11 pp. Upper Darby.

A review of the need for accurate information about timber resources and early attempts to obtain such information, and a description of the Forest Survey in the Northeast, its methods and objectives. The author points out that the needs of states, counties, communities, and local industries for timber-supply statistics have been assuming great importance. The cooperation offered by states and other interested groups is a major factor in Forest Survey work.

# PHOTOGRAMMETRY

Buttrick, John.
1944. THE USE OF AERIAL PHOTOGRAPHS IN FOREST SURVEYS: A SELECTED BIBLIOGRAPHY. Northeast. Forest Expt. Sta. 18 pp. Philadelphia.

A bibliography of references from 1887 (uses of balloon photography) to 1944. It includes articles dealing with land classification, such as delineation and estimation of forest areas; the condition of the forest, its site quality and species composition; estimation of timber volume through photogrammetric methods; and equipment designed or adapted for this kind of work. Arranged chronologically, with author index.

* Hartman, Fred J.
1947. A SIMPLIFIED METHOD FOR LOCATING SAMPLE PLOTS ON AERIAL PHOTOGRAPHS. Northeast. Forest Expt. Sta. Note 3. 3 pp., illus. Philadelphia.

A description of two devices used in stereoscopic work to locate forest survey sample plots. A pair of transparent templates is used over the stereo pairs for locating sample plots; they also lessen error due to differences in elevation. A plunger-type rubber stamp for marking locations of sample plots is also described.

Rogers, Earl J.
1942. AERIAL PHOTOGRAPHS IN TIMBER ESTIMATING. Jour. Forestry 40: 430-432.

Proposes a central office in the United States to act as a clearing house for all information concerned with the use of aerial photographs in forestry. This proposed office would be responsible for review of all literature, development of special equipment, methods and techniques.

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1945. CURVES FOR DETERMINING TREE HEIGHTS FROM SHADOW MEASUREMENTS ON VERTICAL AERIAL PHOTOS. Northeast. Forest Expt. Sta. 2 pp. each. Philadelphia.

A set of seven sheets containing curves for converting shadow lengths (on vertical aerial photos) to tree heights, according to methods outlined by Rogers in Northeast.

Forest Expt. Sta. Paper 12 (1947) and Jour. Forestry 47: 182-191, 1949 ("Estimating Tree Heights From Shadows On Vertical Aerial Photographs"). Curves were prepared for N. latitudes 22°, 24°, 26°, 28°, 30°, and 32°. For each latitude two sets of curves were made, one for fall and winter months, one for spring and summer months. From these curves, other curves can be prepared for use in any latitudes between 21°N. and 49°N.

* Rogers, Earl J.

1946. USE OF THE PARALLAX WEDGE IN MEASURING TREE HEIGHTS ON VERTICAL AERIAL PHOTOGRAPHS. Northeast. Forest Expt. Sta. Forest Survey Note 1. 17 pp., illus. Philadelphia.

Helpful hints on the use of the parallax wedge for measuring tree heights on aerial photographs. Three methods are given for converting the wedge readings to tree heights in feet. The author encourages the use of this instrument by the forester to reduce cost and time in making forest surveys. Further tests are needed to determine the applicability of the parallax wedge to a wide variety of terrains and forest covers.

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1947. ESTIMATING TREE HEIGHTS FROM SHADOWS ON VERTICAL AERIAL PHOTOGRAPHS. Northeast. Forest Expt. Sta. Paper 12. 16 pp., illus. Philadelphia.

Tree heights estimated from aerial photographs can be used in estimating timber volume, and this method is being widely used in forest survey. Describes methods of measuring tree shadows and converting shadows to tree heights; and methods of determining photo scale, time and date of photo exposure. The use of mechanical devices for measuring shadows and of graphs for converting them to tree heights is illustrated.

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1948. PHOTOGRAMMETRY AND FORESTRY.
Photogrammetric Engin. 14: 537-538.

A plea for more research in aerial photo interpretation, especially in large-scale sample aerial photos as used in forest survey work. Based on a talk before the annual meeting of the American Society of Photogrammetry.

* Rogers, Earl J.
1948. A SHORT CUT FOR SCALING AERIAL PHOTOS. Northeast. Forest Expt. Sta. Paper 20. 10 pp., illus. Upper Darby.

Description of a short-cut method for determining an average scale for aerial photographs used in forest survey. By scaling 10 photos selected at random from an aerial photo project, an average scale (at sea level) can be computed that is reasonably accurate (standard error about 1 percent). From the average scale, adjustments can be made for different elevations above sea level.

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1949. ESTIMATING TREE HEIGHTS FROM SHADOWS ON VERTICAL AERIAL PHOTOGRAPHS. Jour. Forestry 47: 182-191, illus.

See above: ROGERS, 1947, Northeast. Forest Expt. Sta. Paper 12.

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1949. A SHORT CUT FOR SCALING AERIAL PHOTOS. Jour. Forestry 47: 819-822, illus.

See above: ROGERS, 1948, Northeast. Forest Expt. Sta. Paper 20.

## RESOURCES

Allegheny Forest Experiment Station and Pennsylvania Department of Forests and Waters.
1944. FOREST AREAS. (OF PENNSYLVANIA) Pa. Dept. Forests and Waters Cir. 35. 64 pp. Harrisburg.

Estimates of forest and nonforest areas for each civil division of the Commonwealth, based on aerial photo interpretation. The report is the result of a cooperative project of the Pennsylvania Department of Forests and Waters and the Allegheny Forest Experiment Station.

Dana, S. T.
1924. THE FORESTS OF MAINE.
Maine Forest Serv. Bul. 2. 28 pp.

A description of the character of the forests, species, and general distribution, and their relation to industry. Maximum lumber production was in 1909, a cut of 1,112,000,000 board feet. In 1921, year of the lowest recorded cut since 1870, production was 422,000,000 board feet. Data are also presented for the pulp-and-paper industry.

Forbes, R. D.
1937. THE JERSEY PINES.
Amer. Forests 43: 521-523, 561, illus.

Vegetation, land use, and the possibilities in managing for forest products, game, and recreation are briefly described for the pine region of southeastern New Jersey. The author suggests a program for developing proper use of this wooded region. This includes an economic survey of the values from the different uses, improved fire protection, and greatly increased public ownership.

Harper, V. L.
1946. HARDWOOD PULP RESOURCES OF THE NORTHEAST.
Northeast. Wood Util. Council Bul. 14: 7-16.

The supply of softwood timber in the Northeast is short of requirements. At the same time, there is a surplus of growth over drain in hardwood stands--much of it in low-grade trees. An expanded use of hardwoods for pulp could help solve the timber-supply problem of northeastern pulp mills, could make possible the practice of better forest management, and could generally raise the value and usefulness of the forest resource of the Northeast.

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1947. TIMBER RESOURCES OF NEW ENGLAND AND NEW YORK WITH SPECIAL REFERENCE TO PULPWOOD SUPPLIES. Tech. Assoc. Pulp and Paper Indus. Monog. Ser. 4: 31-39.

A discussion of the pulpwood supply of the Northeast's large pulp-and-paper industry. Major problems are the heavy drain on softwoods by cutting, and damage by insects such as the spruce budworm. The use of more hardwood for pulp, and better management of all timber resources, are proposed as vital to the future of this industry.

* Harper, V. L.
1947. TIMBER RESOURCES OF NEW ENGLAND AND NEW YORK WITH SPECIAL REFERENCE TO PULPWOOD SUPPLIES. Northeast. Forest Expt. Sta. Paper 5. 8 pp. Philadelphia.

See above.

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1949. THE WOOD-SUPPLY SITUATION IN NEW YORK STATE WITH SPECIAL REFERENCE TO WOOD FOR PULPING. Northeast. Forest Expt. Sta. 13 pp., illus. Upper Darby.

The forests of New York State provide only 231,000 tons of pulpwood for the State's paper-and-paperboard industry, which consumes annually about 1,862,000 tons of fibrous raw material. The State imports large quantities of pulpwood and wood pulp to make up its deficit in raw material. The author proposes that the State intensify its forest management and grow more of the timber it needs.

* ---------- and Rettie, J. C.
1949. THE WOOD-SUPPLY SITUATION IN NEW YORK STATE WITH SPECIAL REFERENCE TO WOOD FOR PULPING. Northeast. Forest Expt. Sta. Paper 29. 14 pp., illus. Upper Darby.

See above. (Revised to include 1947 data.)

* Hough, A. F.
1936. ESTIMATED AREA OF FOREST LAND IN THREE MAJOR FOREST REGIONS OF THE ALLEGHENY FOREST EXPERIMENT STATION TERRITORY. Allegheny Forest Expt. Sta. Tech. Note 11. 2 pp., illus. Philadelphia.

A tabulation of the acreages of the major forest regions in Pennsylvania, Maryland, New Jersey, and Delaware, with brief descriptions of the forests: oak, beech-birch-maple, and hard pine-oak.

Northeastern Forest Experiment Station.
1944. FOREST CONDITION MAPS.
Northeast. Forest Expt. Sta. Philadelphia.

Maps showing the saw-timber, cordwood, and unmerchantable forest areas of the following Pennsylvania counties: Dauphin, Lackawanna, Lebanon, Monroe, Montour, Northumberland, Pike, and Schuylkill. Blue-line prints. Scale: 1 inch = 1 mile.

Northeastern Forest Experiment Station.

1944. LAND USE MAPS.
Northeast. Forest Expt. Sta. Philadelphia.

Land use maps for each of the following Pennsylvania counties: Carbon, Columbia, Dauphin, Lackawanna, Lebanon, Luzerne, Monroe, Montour, Northumberland, Pike, Schuylkill, Sullivan, Susquehanna, Wayne, and Wyoming. Blue-line prints. Scale: 1 inch = 1 mile.

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1948. FOREST RESOURCES OF ELK, FOREST, McKEAN, AND WARREN COUNTIES, PENNSYLVANIA. Northeast. Forest Expt. Sta. Forest Survey Release 1. 30 pp. Upper Darby.

Statistics on forest area and timber volume, by county, ownership class, forest type, stand size, site, and species. The over-all situation is summarized. A brief description of forest survey procedures, an estimate of the accuracy of the data, and an explanation of the terms used are appended.

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1949. FOREST STATISTICS FOR PENDLETON, POCAHONTAS, AND RANDOLPH COUNTIES, WEST VIRGINIA. Northeast. Forest Expt. Sta. Forest Survey Release 2. 34 pp. Upper Darby.

Statistics on forest area and timber volume. Additional information as above.

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1949. FOREST STATISTICS FOR NORTHERN NEW HAMPSHIRE. Northeast. Forest Expt. Sta. Forest Survey Release 3. 36 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

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1949. FOREST STATISTICS FOR HANCOCK COUNTY, MAINE. Northeast. Forest Expt. Sta. Forest Survey Release 4. 30 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

* Northeastern Forest Experiment Station.
1949. FOREST STATISTICS FOR SOUTHERN NEW HAMPSHIRE. Northeast. Forest Expt. Sta. Forest Survey Release 5. 36 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

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1949. FOREST STATISTICS FOR MONONGAHELA SECTION, WEST VIRGINIA. Northeast. Forest Expt. Sta. Forest Survey Release 6. 34 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

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1949. FOREST STATISTICS FOR SOUTHEASTERN WEST VIRGINIA. Northeast. Forest Expt. Sta. Forest Survey Release 7. 35 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

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1949. FOREST STATISTICS FOR CUMBERLAND MOUNTAINS SECTION, WEST VIRGINIA. Northeast. Forest Expt. Sta. Forest Survey Release 8. 35 pp. Upper Darby.

Statistics on forest area and timber volume. See above.

Rettie, James C.
1948. AVAILABILITY OF BARK IN THE NORTHEAST. Northeast. Forest Expt. Sta. 12 pp. Upper Darby.

There are tough economic problems to be overcome before wood bark can be used in large quantities as industrial raw material. There are about 800,000 tons available annually, but it is scattered at hundreds of small mills. Chemists and physicists will have to find some real values in it before it can be utilized economically.

Rettie, James C., and Simmons, Fred C.
1949. ESTIMATES OF BARK SUPPLY IN THE NORTHEAST. Northeast. Wood Util. Council Bul. 25: 7-18, illus.

Some of the new products coming out of the laboratories open a way for using more tree bark as raw material. There is plenty of bark (about 800,000 tons), most of it going to waste. But it is scattered at many small mills. It is not an attractive source for large-volume industrial use. It is so scattered that it cannot be obtained at reasonable cost.

---------- and Simmons, Fred C.
1949. ESTIMATES OF BARK SUPPLY IN THE NORTHEAST. Paper Trade Jour. 128 (15): 21-23, illus.

See above.

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1949. WHERE IS THE BARK? Forest Leaves 34 (1): 5-6.

See above.

## REQUIREMENTS

Behre, C. Edward.
1936. THE PART THE SOUTH MAY PLAY IN MEETING NATIONAL NEWSPRINT REQUIREMENTS. Jour. Forestry 34: 191-197.

The opening paper in a symposium on "Newsprint Paper from Southern Woods" at the 1936 annual meeting of the Society of American Foresters. Digests information on the Hale Report on estimated national requirements for newsprint, and attempts to forecast the proportion that might be supplied by southern woods.

Behre, C. Edward.
1941. ABILITY OF NEW ENGLAND FORESTS TO MEET INCREASED DEMANDS FOR FOREST PRODUCTS RESULTING FROM WAR. Jour. Forestry 39: 788-793, illus.

Consideration of the possible impact of war demands on New England forests. The author discusses effect of possible transportation breakdown and resultant fuel and lumber shortage in the Northeast. He estimates that cut would exceed growth by 60 percent to maintain the prospective level of defense production. Recommends public control to prevent needless sacrifice of productive resources and to avoid confusion in meeting demands.

Curran, C. E., and Behre, C. E.
1935. NATIONAL PULP AND PAPER REQUIREMENTS IN RELATION TO FOREST CONSERVATION. U. S. 74th Cong. 1st sess. Doc. 115. 74 pp., illus.

A report on National pulp and paper requirements, in response to Senate resolution No. 205 (73d Congress).

* Ferree, Miles J.
1947. TIMBER REQUIREMENTS OF ANTHRACITE MINES. Northeast. Forest Expt. Sta. Note 4. 3 pp., illus. Philadelphia.

A brief discussion of the wood products needed in anthracite mining. A survey of coal mines showed that anthracite mines in Pennsylvania use up nearly 1 cubic foot of wood for every ton of coal they produce, and that this proportion of wood needed per ton of coal is constantly increasing.

Rettie, James C., and Hallauer, Frank.
1946. POTENTIAL REQUIREMENTS FOR TIMBER PRODUCTS IN THE UNITED STATES. (REPORT 2 FROM A REAPPRAISAL OF THE FOREST SITUATION.) U. S. Forest Service. 70 pp., illus. Washington.

The authors estimate for the Forest Service the quantity of timber products that might be used by consumers in the United States in the future, in a national economy functioning at a high level of employment and output. The estimates, called "potential timber requirements" are primarily for use in planning for the amount of timber that must be grown to meet such requirements.

* Rettie, James C.
1948. THE PURPOSE AND BASIC CONCEPTS OF TIMBER CONSUMPTION AND REQUIREMENTS STUDIES. Jour. Forestry 46: 237-242.

An explanation of the factors underlying estimates made by the U. S. Forest Service of present and potential future requirements for timber supplies. The concept rests on such basic economic features as industrial requirements under conditions of full employment, and realizable goals of forest productivity.

## PRODUCTION

* Allegheny Forest Experiment Station.
1943. PRELIMINARY ESTIMATE OF LUMBER PRODUCTION, 1942 - MIDDLE ATLANTIC STATES. Allegheny Forest Expt. Sta. Tech. Note 41. 1 p. Philadelphia.

A table showing estimated 1942 lumber production, by states. Production estimates are given for species and for large (more than 50,000 board feet) and small (less than 50,000 board feet) sawmills.

* Forbes, R. D.
1935. FOREST AREA ANNUALLY CUT OVER. Allegheny Forest Expt. Sta. Tech. Note 8. 1 p. Philadelphia.

The annual forest area cut over in Delaware, Maryland, New Jersey, and Pennsylvania was computed from available data on forest products harvested in 1925-29 and from estimated stands per acre. Annual cut was estimated at 366,092 acres, about 1.8 percent of the total forest area of the region.

* Jensen, Victor S., and Desmond, Richard C.
1942. NORTHEASTERN LUMBER PRODUCTION IN 1941. Northeast. Forest Expt. Sta. Tech. Note 53. 1 p. New Haven.

Lumber production in Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont was estimated from mailed questionnaires and a partial field canvass. Production figures were: hardwood, 274,519,000 board feet;

softwood, 1,011,328,000 board feet. The total of 1,285,847,000 board feet is compared with the production of 713,791,000 board feet in 1940.

Jensen, Victor S.
1944. THE DRAIN UPON FOREST CAPITAL DURING 1942 AND 1943. N. H. Forestry and Recreation Comn. Bien. Rpt. 1943-44: 60.

Direct and indirect war demands became apparent as lumber production in New Hampshire increased to 361,494,000 board feet in 1942 (the greatest since 1915, when 389 million board feet were cut). In 1943 lumber production was 392,332,000 board feet, and total drain of all forest products was estimated at about 700 million board feet, or 1,400,000 cords.

* Schnur, G. Luther.
1943. LUMBER PRODUCTION, 1942 - NEW ENGLAND. Allegheny Forest Expt. Sta. Tech. Note 39. 2 pp. Philadelphia.

Sawmills in the six New England States produced an estimated cut of 1,042 million board feet in 1942, as compared with 975 million feet in 1941, an increase of 7 percent. White pine made up 63 percent of the total cut; it was used in quantity for boxes, then in great demand for shipping all kinds of war supplies.

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1944. LUMBER PRODUCTION IN PENNSYLVANIA. Forest Leaves 34 (4-5): 12-13.

During the first quarter of 1944 Pennsylvania continued to lead the Northeastern States in lumber production. The author points out that there has been a long downward trend in lumber production since 1899, dropping from 2½ billion board feet in 1899 to 72 million board feet in 1932. Present cut exceeds annual growth, but is expected to level off temporarily somewhere near the annual growth.

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1944. LUMBER PRODUCTION TRENDS. NORTHEASTERN STATES, 1943. Allegheny Forest Expt. Sta. Occas. Paper 6. 24 pp., illus. Philadelphia.

A survey of monthly lumber production in the 11 Northeastern States was made as an aid to administering price

controls and priorities. Statistics on production are given by states and species. Trends of production for the Northeast are compared with those of the United States as a whole.

Taylor, R. F.
1943. PRODUCTION EFFICIENCY--WITH A GAP. The Plan 23 (3): 36.

An alarming amount of lumber is needed for wartime purposes, but there is no good reason for hacking down every tree on a woodlot. Clear-cutting destroys the small trees that might have been tomorrow's sawlogs. Lumber dealers will feel the results of this waste some day.

* Westveld, Marinus.
1942. MIDDLE ATLANTIC STATES PRODUCED HALF BILLION FEET OF LUMBER IN 1941. Allegheny Forest Expt. Sta. Tech. Note 35. 1 p. Philadelphia.

A summary of sawmill production in 1941 for Pennsylvania, Maryland, Delaware, and New Jersey. Lumber production data in tabular form to show, by states, the 1940 and 1941 production of hardwoods and softwoods. The author contrasts present productivity of forest lands with what could be expected under good cutting practices.

## TAXATION

Forbes, R. D., and Beck, C. W.
1941. TAX DELINQUENCY OF FOREST LANDS IN THE ANTHRACITE FOREST REGION OF PENNSYLVANIA: A COUNTY OPPORTUNITY AND RESPONSIBILITY. Allegheny Forest Expt. Sta. Anthracite Survey Paper 3. 16 pp., illus. Philadelphia.

A progress report on the extent, importance, and probable causes of tax delinquency of forest lands. The tax-delinquent lands are a major problem to the counties. The authors point out an opportunity for the counties to establish county forests, which could eventually provide many benefits to the people.

Forbes, R. D., and Beck, C. W.
1944. COUNTY FOREST POSSIBILITIES IN THE ANTHRACITE REGION. Forest Leaves 33 (6): 1-2.

See above.

## INSURANCE

* Shepard, H. B.
1939. FOREST FIRE INSURANCE IN THE NORTHEASTERN STATES. U. S. Dept. Agr. Tech. Bul. 651. 46 pp., illus.

An inquiry into the practical possibilities of fire insurance for forest properties in the northeastern United States. Divides the area into four regions for purpose of collecting and analyzing forest fire data. Hazards and protection are discussed. Sample application forms for insurance are shown and several proposed rates are outlined. The author believes that such insurance is practical.

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1943. FOREST ENTERPRISE: OPPORTUNITY FOR PROFITS OR SECURITY? Jour. Forestry 41: 443-445.

The returns from investments are usually in direct ratio to risks. Investments in forestry are full of risks, such as fire, insects, tree diseases, wind, ice storms, drought, flood, and animals. The author recommends that forest insurance be made available so that forestry can compete for capital.

Stickel, Paul W.
1924. SOME SUGGESTIONS FOR PROPOSED CHANGES IN THE METHODS OF COLLECTING FOREST FIRE STATISTICS. Jour. Forestry 22: 266-274.

Better forest fire statistics are needed as a basis for more fair rates for forest fire insurance. Insurance rates should be based on a scientific evaluation of hazard and should vary according to risk. The author proposes a method of collecting forest fire statistics that will provide data usable for determining risk according to forest types, size classes, and aspect.

* Williams, Ellis T.
1949. FOREST INSURANCE.
Northeast. Forest Expt. Sta. Paper 26. 85 pp.
Upper Darby.

A comprehensive survey of the history of forest insurance and the need for this kind of protection in the United States. Problems of underwriting forest insurance, and efforts to meet these problems in Europe and the United States are reviewed. The author believes that stock companies are in the best position to write forest insurance in the United States. He recommends that the insurance business take the initiative in considering the subject and set up a committee to explore aspects of the problem that need further study; that private companies set up a pool to write commercial forest insurance in areas that are ready for it; and that Government-private underwriting be provided for meeting the needs of those who do not qualify for commercial coverage.

# WATERSHED MANAGEMENT

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Behre, C. Edward.
1932. ARE FURTHER STUDIES NEEDED ON THE RELATION OF FORESTS TO WATER SUPPLY IN NEW ENGLAND? Jour. New England Waterworks Assoc. 46: 170-183.

The dry years 1929-30 revealed a serious problem in New England when communities had to compete for the available water supply. The author proposes a Nation-wide research program on erosion and stream flow.

Bevan, Arthur.
1947. FLOOD CONTROL SURVEYS IN THE NORTHEAST. Northeast. Forest Expt. Sta. Paper 10. 9 pp., illus. Philadelphia.

A general discussion of the need for flood-control measures in the Northeast, and the activities under flood-control surveys.

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1948. FLOODS AND FORESTRY. Wash. Univ. Forest Club Quart. 22 (2): 3-8, illus.

A discussion of the 1948 flood in the Columbia River Basin and the conditions that brought it about: fire, overgrazing, poor logging practices, and poor farming practices.

Diebold, C. H.
1940. STRIP PLANTING FOR FLOOD CONTROL. Jour. Forestry 38: 810-812, illus.

A typical plan is described for strip-planting an idle field in the Youghiogheny watershed (southwestern Pennsylvania). Data are presented on length of time required for planting several coniferous species to obtain crown closure and to build up a humus layer.

* Forbes, R. D.
1931. WATERSHED COVER AND WATER CONSERVATION.
Allegheny Forest Expt. Sta. 7 pp. Philadelphia.

In an address before the Maryland and Delaware Water and Sewerage Association at Wilmington, the author pointed out that European investigators have found that once rainfall has reached the ground, vegetative cover lessens evaporation by shading and by forming a surface mulch of dead leaves. He outlined other studies and findings on the effect of vegetative cover in controlling runoff and erosion.

---------- Schnur, G. L., and others.
1933. WATERSHED AND RELATED FOREST INFLUENCES.
In A National Plan For American Forestry. 73d Cong. 1st sess., Sen. Doc. 12: 299-461. (Copeland Report.)

Research and observation in all parts of the United States justify a strong belief that forests practically always benefit stream flow. Forest litter reduces surface runoff and increases the water-storing capacity of the soil. The climax forest was admirably adapted to promoting stream-flow conditions favorable to mankind. Permanent vegetative cover on a watershed also prevent erosion; this is shown by the relative clarity--even in flood--of streams flowing from forests or permanent sod, as compared with the turbidity of streams flowing from cultivated lands.

* ----------
1934. RULING THE RIVER.
Sci. Monthly 38: 524-533, illus.

A general article about the influences that forests have on streamflow. The author stresses the influence of forest humus on infiltration, and the influence of forest cover in retarding snow melt, thus reducing flood stages.

----------
1936. FORESTS AND FLOOD CONTROL.
Forest Leaves 26 (4): 19-20.

The U. S. Army Engineers, who dominate the Federal efforts in this field, have been asking foresters just what the favorable influence is that forests have on stream flow. The usual answer is: "We can't tell you because we never made any experiments under the particular conditions you describe."

There is a definite need for experimentations in watershed management to obtain the answers to these problems.

Gedney, Donald R.
1949. LAND ABUSE, A FLOOD, AND THEN MORE FLOODS. Forest Leaves 34 (1): 17.

A story of constantly increasing flood damages in part of the Allegheny River watershed, where, as a result of abuses of the land, floods are becoming more frequent and more destructive. Homes 100 years old have started to settle in the softened soil; culverts can no longer handle the high water. Farms are being abandoned. Land and property values are dropping. Expedient measures have helped to check the damage, but the end is not yet in sight; and there will be no end until the land has again become stabilized and erosion has been stopped.

Grossman, Sidney J.
1941. COMMENTS ON "STRIP PLANTING FOR FLOOD CONTROL". Jour. Forestry 39: 728-730.

The author takes exception to an article by Diebold in the Journal of Forestry in 1940. The salient point is a warning that caution must be used in generalizing the effects of coniferous plantations on soil. The economic value of planting fast-growing species is questionable when compared to slower-growing, more desirable species.

Morey, Harold F.
1942. THE APPLICATION OF OUR KNOWLEDGE OF THE ORGANIC LAYERS OF THE SOIL PROFILE TO FLOOD CONTROL. Pa. State Col. School Engin. Tech. Bul. 27: 143-151.

Defines cover-soil complexes, humus types, and soil-profile layers as they were determined by the Connecticut Flood Control Survey of the Department of Agriculture. Humus depth is related to age of stand and to forest practices and protection. Soil-moisture curves are derived for the cover-soil complexes. Discussion by William Mollenhauer, Jr., who describes the effect of delayed moisture depletion of the soil on flood runoff.

Storey, Herbert C.
1949. WATERSHED RESEARCH IN THE DELAWARE AND LEHIGH. Forest Leaves 34 (1): 15-16.

A description of the watershed research being carried out in the Delaware River watershed by the Northeastern Forest Experiment Station. The author relates the importance of adequate water supplies to the Northeast, and describes a sample watershed being studied in the Delaware-Lehigh Experimental Forest, in the scrub oak lands of Monroe County, Pennsylvania. The objective of the study is to convert these lands to good timber stands, then to measure the hydrologic effects of this conversion.

* Trimble, G. R., Jr., and Tripp, Norman R.
1949. SOME EFFECTS OF FIRE AND CUTTING ON FOREST SOILS IN THE LODGEPOLE PINE FORESTS OF THE NORTHERN ROCKY MOUNTAINS. Jour. Forestry 47: 640-642.

Cursory observation indicates that rapid runoff and erosion result from fire and cutting in the lodgepole pine forests. Even when a burn is fully restocked, 30 to 40 years must elapse after establishment of the stand before any appreciable litter and humus layer begins to form. The authors say research is needed on the watershed-management problems of the region.

* Wood, O. M.
1937. THE INTERCEPTION OF PRECIPITATION IN AN OAK-PINE FOREST. Ecology 18: 251-254.

Interception was determined as difference in catch of precipitation in rain gages set up in a mixed forest of oak and pine, and in the open at Ockanickon Experimental Forest, Medford, N. J., during 1932-34. The total catch of four gages in the woods averaged 87.2 percent of that caught in the open. The proportion of rain reaching the ground in the woods increased with intensity and duration of the storm.

# MISCELLANY

## WILDLIFE

(See also "Forest Protection--Birds and Animals")

Harding, Merritt J.
1939. LET'S LOOK AT THE PENNSYLVANIA STATE GAME COMMISSION. Forest Leaves 29 (1): 5, 15, illus.

Following the deer-hunting season of 1938 the Pennsylvania State Game Commission was criticized for the open season on antlerless deer. It is generally accepted that between 60 and 66 acres of woodland are needed to support one deer. At one typical area the deer were so overcrowded they were forced to exist on 1½ acres. The open deer season was declared to alleviate this overpopulation.

Pearce, John.
1938. FOREST WILDLIFE RELATIONSHIPS IN THE NORTHEAST. Northeast. Forest Expt. Sta. 32 pp. New Haven.

A discussion of the wildlife resources of the Northeast and the problem of fitting them into the multiple uses of the region's forests. Game animals and birds and furbearers are discussed; and some animals are listed as potential enemies of the forests. The author sees a big problem in correlating forestry and wildlife, and a need for cooperation among state, Federal, and private agencies.

Pearce, John, and Spaulding, Perley.
1942. PLANT PATHOLOGY IN RELATION TO NORTHEASTERN FOREST WILDLIFE COVER. Jour. Wildlife Mangt. 6: 194-202, illus.

A discussion of the significance of some of the more common diseases of northeastern trees and shrubs that are planted or favored in wildlife management. These diseases must be considered when food or cover plants are established for wildlife food and cover, for, although some diseases provide food (fungi fruits and diseased plant tissue) and shelter (hollow trees and logs), others destroy foliage and fruit that are useful food and cover.

## RECREATION

* Hough, A. F.
1941. RECREATION IN PENNSYLVANIA'S WOODLANDS.
Allegheny Forest Expt. Sta. 4 pp. Philadelphia.

Pennsylvania's State Forests include 1,650,000 acres, which offer recreation for city dwellers. The State has made many improvements to fill the need for recreational areas, and Federal works programs have accelerated improvements. Recreational areas are listed, and facilities and costs are described.

## EDITORIAL AFFAIRS

Dana, Samuel T.
1926. THE EDITOR'S SILVER JUBILEE.
Jour. Forestry 24: 845-846.

As president of the Society of American Foresters, the author pays tribute to Raphael Zon, editor of the Journal of Forestry, who in 1926 completed 25 continuous years in the service of the U. S. Forest Service.

Jacot, Arthur Paul.
1937. PRINCIPLES OF SCIENTIFIC PUBLICATION.
Jour. N. Y. Ent. Soc. 45: 127-128.

The author makes a plea in behalf of the scientific researcher who must bear personally the costs of publishing his findings. He declares that all results of research should be published. "Data unpublished is data lost...Society's obligation is to endow scientific publications, as well as museums, hospitals, university buildings, bell towers, and dog cemeteries."

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1938. AUTHORITY CITATIONS IN BIOLOGICAL NOMENCLATURE.
Science 88: 240.

The author argues against dual authority citations. He concludes that nomenclature would be advanced by discarding the original authority and supplanting it by reference to the best description--usually the latest family or generic monograph on the species in question.

* Larson, Edwin vH.
1946. BAD STUFF IN WRITING.
Northeast. Forest Expt. Sta. 2 pp. Philadelphia.

A common fault in forestry research reports is the unscientific use of old phrases that have been worn out. Often they mean nothing at all. "When they come into the writer's mind...he should take warning...because what he is writing is bad stuff, or it would not need such (phrases); let him see to the substance of his cake instead of decorating it with sugarplums." (--Fowler) A number of examples from manuscripts are given.

* ---
1947. TABLES FOR TECHNICAL WRITERS.
Northeast. Forest Expt. Sta. Paper 3. 47 pp.
Philadelphia.

A manual outlining principles of tabular presentation, with sample tables showing right and wrong methods. Based on Department of Agriculture and Forest Service editorial customs.

* Larson, Edwin vH.
1947. STYLE MANUAL FOR PUBLICATIONS. Northeast. Forest Expt. Sta. Paper 6. 28 pp. Philadelphia.

A manual for authors and typists, presenting style rules for the preparation of research publications. Based on the Government Printing Office Style Manual and Department of Agriculture and Forest Service editorial customs.

Reineke, L. H.
1941. LEGEND FOR SOCIETY OF AMERICAN FORESTERS: FOREST COVER TYPES FOR THE EASTERN UNITED STATES. Northeast. Forest Expt. Sta. Occas. Paper 13. 12 pp., illus. New Haven.

A system of symbols, for use on maps, to show various forest types. The symbols complement the Society of American Foresters forest-type classifications. Various patterns and colors are used in different arrangements to depict the various forest types.

Spaulding, Perley.
1925. REPORT OF EDITOR-IN-CHIEF OF PHYTOPATHOLOGY. Phytopathology 15: 310-312.

A report of editorial activities during the year 1924. The editor deplores the increasing tendency of scientific workers to ignore antecedent published work connected with their particular problems. He believes editorial censorship is needed to combat this tendency.

## ODDS AND ENDS

Duffield, J. W.
1941. TEMPERATURE CONTROL FOR MICROTOME KNIVES. Stain Technol. 16 (3): 123-124, illus.

A short description of a device used to control the temperature of a microtome knife during paraffin sectioning. Provision is made for either chilling or warming the knife by means of water circulation.

Jensen, Victor S.
1933. RELIEF MAP CONSTRUCTION.
Jour. Forestry 31: 477-478.

The author describes techniques, methods, and materials used in preparing relief maps.

Lisi, Alfred G., and Doak, K. D.
1935. AN ABNORMAL AMANITA MUSCARIA.
Pa. Acad. Sci. Proc. 9: 86.

Abnormal, reticulately gilled specimens of Amanita muscaria have been found in a portion of the Morris Arboretum in Philadelphia. This form is described.

Little, Silas.
1948. ELLWOOD B. MOORE.
Jour. Forestry 46: 769-770, illus.

A profile sketch of "Slim" Moore, chief of the Bureau of Forest Management of the New Jersey Department of Conservation.

* Mollenhauer, Wm. J.
1938. SPRING STRUCTURES.
Allegheny Forest Expt. Sta. Misc. Note 1. 2 pp., illus. Philadelphia.

Design and description of a small stone structure to catch and store spring water. Developed in the Standing Stone Experimental Forest in Pennsylvania to assure potable water during dry seasons and an emergency supply for fire pumps.

Reineke, L. H.
1940. LOOK BEFORE YOU SWAT.
U. S. Forest Serv. Bul. 24 (13): 4-5.

A warning to persons who work in the woods about tularemia and Rocky Mountain Spotted Fever. Deer flies and common dog ticks can transmit these diseases to man even when squashed on unbroken, unbitten skin.

* Reineke, L. H.
1941. A NEW INCREMENT CORE INSTRUMENT AND CORING WRINKLES. Jour. Forestry 39: 304-309, illus.

The author describes a device to aid in the collection and study of increment cores. The specifications, functions, and operations of the instrument are described. Several recommendations are made concerning shaving, transportation, and preservation of cores, and sharpening of increment borers.

Rutherford, William Jr.
1949. THE BEAUFORT WIND SCALE. Lumber Camp News 11 (1): 16.

A brief description of the Beaufort scale of wind velocities and how it can be put to practical use by men who work in the woods.

Shirley, Hardy L.
1941. JOINT MEETING OF THE ECOLOGICAL SOCIETY OF AMERICA AND THE SOCIETY OF AMERICAN FORESTERS AT PHILADELPHIA. Jour. Forestry 39: 330-331.

A list of the speakers and the papers given at the joint session of the Ecological Society of America and the Society of American Foresters in conjunction with the 1946 meeting of the American Association for the Advancement of Science.

Spaulding, Perley.
1932. LEIGH HUMBOLDT PENNINGTON: 1877-1929. Phytopathology 22: 873-877, illus.

A short biography and character sketch of Dr. Leigh H. Pennington.

---
1933. DIETRICH PREFERABLE AUTHORITY FOR CRONARTIUM RIBICOLA. Phytopathology 23: 203-204.

From evidence submitted by Klebahn, the author concludes that Dietrich should be given the credit for discovering, recognizing, and naming the fungus Cronartium ribicola.

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All authors, coauthors as well as senior authors, are listed in alphabetical order. The numbers refer to the pages on which the citations appear.


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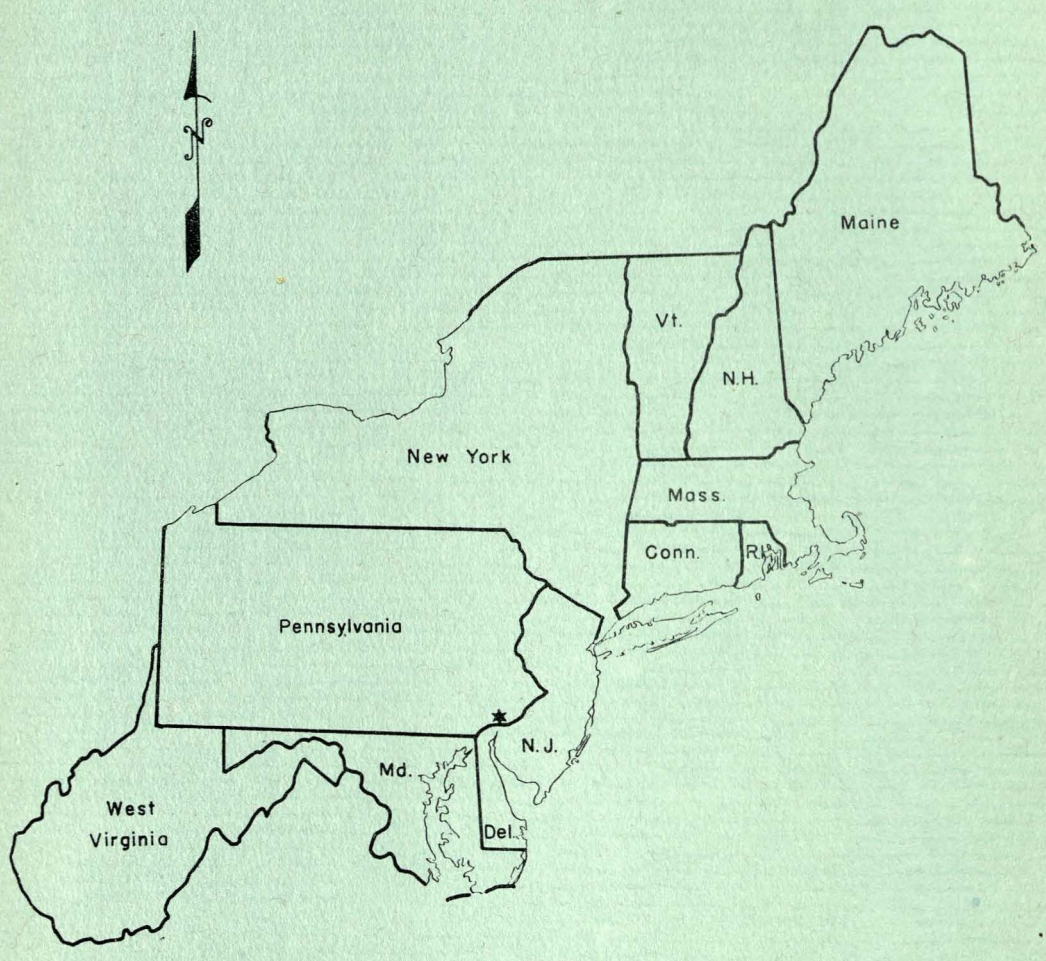


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